ADDISON WESLEY

Ontario

Math Makes Sense 7

Ontario 2005

Curriculum Companion

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Using Your Curriculum Companion

Addison Wesley Mathematics Makes Sense is comprehensive program designed to support teachers in delivering core mathematics instruction in a way that makes mathematical concepts accessible to all students – letting your teach for conceptual understanding, and helping students make sense of the mathematics they learn. ***Addison Wesley Mathematics Makes Sense*** was specifically written to provide 100% curriculum coverage for Ontario teachers and students. The ***Math Makes Sense*** development team wrote, reviewed, and field tested materials according to the requirements of The Ontario Curriculum, Mathematics, released in 1997. Now, with Ontario's initiative or Sustaining Quality Curriculum, the same development team is pleased to provide further support in this **Curriculum Companion**.

Your Curriculum Companion provides you with the specific support you need to maintain 100% curriculum coverage according to the revised 2005 release of The Ontario Curriculum. In this module, you will find:

What's New at Grade 7?
This one-page overview provides your year-at-a-glance, with notes detailing where new curriculum requirements have arisen in the 2005 curriculum.

Unit Planning Charts
For each unit, a one-page overview that recommends required or optional lessons, and indicates whether this module provides additional teaching support to ensure curriculum coverage.

Curriculum Focus Notes
The revised curriculum introduced some new expectations that already form part of the overall conceptual framework on which your Grade 7 program was built. In order to meet these expectations in a more explicit way, **Curriculum Focus Notes** suggest ways that you might use the ***Math Makes Sense 7*** Student Book lesson content to address the expectations. If relevant, the suggestion includes use of an **Extra Practice** master, available in reproducible form following the teaching notes.

Curriculum Focus Lessons
Some expectations in the 2005 revised curriculum for Grade 7 call for additional conceptual development. For these expectations, this module provides a complete plan with detailed teaching notes, reproducible student pages, and a Step-by-Step master, all matching the instructional design of your core Teacher Guide and Student Book. **Curriculum Focus Lessons** are numbered in a logical unit flow: for example, Section 9.7A is designed to follow Section 9.7 and lead into Section 9.8.

Curriculum Focus Notes and **Curriculum Focus Lessons** follow in sequence, where relevant after the **Unit Planning Chart**.

Reproducible Masters, with Answers
You'll find reproducible masters provided for any expectation that requires such additional support. Answers for masters are provided with the teaching notes.

Curriculum Correlation
Go to page 77 to find detailed curriculum correlation that demonstrates where each expectation from your grade 7 curriculum is addressed in ***Addison Wesley Math Makes Sense 7****.*

What's New at Grade 7?

Unit	Curriculum Focus Notes	Curriculum Focus Section Masters
3	3.5: Surface Area of a Rectangular Prism	
4	4.7: Multiplying Decimals	
		Section 4.7A: Dividing Whole Numbers by Fractions and Decimals
	4.8: Dividing Decimals	
	4.9: Order of Operations with Decimals	
5	5.1: Collecting Data	
	5.5: Applications of Mean, Median, or Mode	
6	6.3: Area and Perimeter of a Trapezoid	
		Section 6.4A: Volume of a Right Prism Section 6.4B: Surface Area of a Right Prism
7		Technology Section 7.1A: Using a Computer to Construct Related Lines and Angle Bisectors
	7.2: Congruent Figures	
		Section 7.2A: Similar and Congruent Figures Technology Section 7.2B: Dilatations
		Section 7.5A: Sorting Triangles and Quadrilaterals by Their Properties
9		Section 9.7A: Plotting Points on a Coordinate Grid
10	10.1: Number Patterns	
	10.4: Evaluating Algebraic Expressions	
11	11.4: Applications of Probability	

Unit 1 Patterns in Whole Numbers

Section	Curriculum Coverage	Section Masters and Materials
Cross Strand Investigation: Making a Booklet	Optional but recommended	
Skills You'll Need	Optional but recommended	
1.1: Numbers All Around Us	Required	
1.2: Factors and Multiples	Required	
1.3: Squares and Square Roots	Required	
1.4: Exponents	Required	
1.5: Number Patterns	Required	
Unit Problem: Fibonacci Numbers	Required	

Cross Strand Investigation: Although this material is not directly required by your curriculum, this investigation allows students to connect their knowledge from several math strands to the real world. It also serves as a valuable instructional tool for activating students' prior learning before they start on a new program of study in Grade 7.

Skills You'll Need: Although this material is not directly required by your curriculum, the material is recommended as a prerequisite for the sections in this Unit.

Unit 2 Ratio and Rate

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Required	
2.1: What Is a Ratio?	Optional but recommended	
2.2: Equivalent Ratios	Optional but recommended	
2.3: Comparing Ratios	Required	
2.4: Applications of Ratios	Required	
2.5: What Is a Rate?	Required	
Unit Problem: Who's the Smartest?	Optional but recommended	

Sections 2.1 and 2.2 While the material in these sections is not specifically required by the Grade 7 curriculum, these sections serve as a review of ratios from Grade 6, and can be used to connect to the new material in Sections 2.3, 2.4, and 2.5. These lessons should be taught in the first year of implementation to accommodate students' transition to the new curriculum.

Unit Problem: Although some of this material is not directly required by the Grade 7 curriculum, the Unit Problem allows students to apply their knowledge of ratio and rate from Grades 6 and 7.

Unit 3 Geometry and Measurement

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Required	
3.1: Sketching Views of Solids	Optional	
Technology: Using a Computer to Draw Views of Solids	Optional	
3.2: Sketching Solids	Optional	
3.3: Building Objects from Nets	Optional	
3.4: Using Variables in Measurement Formulas	Optional	
3.5: Surface Area of a Rectangular Prism	Required: see Focus Note 3.5	
3.6: Volume of a Rectangular Prism	Required	
Unit Problem: Making Food for a Bake Sale	Optional	
Cross Strand Investigation: Ratios in Scale Drawings	Required	

Sections 3.1 to 3.3: The material in these sections is not required by the Grade 7 curriculum. However, these lessons should be taught in the first year of implementation to accommodate students' transition to the new curriculum.

3.5: Surface Area of a Rectangular Prism

Focus Note 3.5

Curriculum expectation: Investigate, using concrete materials, the angles between the faces of a prism, and identify right prisms.

Curriculum Focus

The curriculum requires that students investigate the angles between the faces of a prism to identify right prisms.

The prisms in this lesson are right prisms. Have students use a protractor to verify that the angle between two adjacent faces of a rectangular prism is a right angle. After you complete Section 6.4A, Volume of a Right Prism, have students repeat the measurements for a triangular prism and a trapezoidal prism. The angle between a base and any rectangular face is a right angle.

Unit 4 Fractions and Decimals

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Required	
4.1: Combining Fractions	Required	
4.2: Adding Fractions Using Models	Required	
4.3: Adding Fractions	Required	
4.4: Subtracting Fractions Using Models	Required	
4.5: Subtracting Fractions	Required	
4.6: Exploring Repeated Addition	Required	
Technology: Fractions to Decimals	Required	
4.7: Multiplying Decimals	Required: see Focus Note 4.7	Master 4.42
4.7A: Dividing Whole Numbers by Fractions and Decimals **Curriculum expectation:** Divide whole numbers by simple fractions and by decimal numbers to hundredths, using concrete materials.	Required	Masters 4.43 to 4.45 Step-by Step 7A: Master 4.46 Base Ten Blocks, fraction strips, number lines
4.8: Dividing Decimals	Required: see Focus Note 4.8	Master 4.47
4.9: Order of Operations with Decimals	Required: see Focus Note 4.9	
Unit Problem: Publishing a Book	Required	

4.7: Multiplying Decimals

Focus Note 4.7

Curriculum expectations: Solve problems involving the multiplication and division of decimal numbers to thousandths by one-digit whole numbers, using a variety of tools and strategies.

Student material: Master 4.42

Curriculum Focus

Your curriculum requires that students use a variety of strategies to solve problems involving multiplying decimals by one-digit whole numbers.

Extend *Connect*. Provide examples that use the distributive property, such as this:

Example Multiply: 9.418 × 7

Solution Think: 9. 418 × 7 = (9 + 0.4 + 0.01 + 0.008) × 7

9.418 × 7 = 9 × 7 + 0.4 × 7 + 0.01 × 7 + 0.008 × 7

= 63 + 2.8 + 0.07 + 0.056

= 65.926

Have students complete Master 4.42, Multiplying Decimals to Thousandths by a Whole Number.

Answers to Master 4.42: 1. Estimates may vary. **a)** 20, 19.5 **b)** 7, 8.26 **c)** 4, 4.204 **d)** 18, 18.9 **e)** 10, 9.875 **f)** 30, 28.884 **2.** 60.2 m^2 **3.** 288.96 s, or 4 min 48.96 s **4. a)** 62.8 km **b)** 314 km **5. a)** $8.05 **b)** $4.20

SECTION 4.7A

4.7A Dividing Whole Numbers by Fractions and Decimals

Curriculum expectation: Divide whole numbers by simple fractions and by decimal numbers, using concrete materials.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Divide whole numbers by fractions and decimals using concrete materials

Student Materials
- Masters 4.43, 4.44, 4.45
- Base Ten Blocks
- fraction strips
- number lines

Optional
- Step-by-Step 7A (Master 4.46)

Assessment: Master 4.2 Ongoing Observations: Fractions and Decimals

Key Math Learnings

1. Dividing a whole number by a fraction can be modelled with fraction strips.
2. Dividing a whole number by a decimal can be modelled with Base Ten Blocks.

BEFORE — Get Started

Review the two meanings of division.

Present *Explore*. Remind students to place their first fraction strip at 0 on the number line. As students place the fraction strips end-to-end, they can see the numbers of fourths that make up 1, 2, 3, 4, and 5.

DURING — Explore

Ongoing Assessment: Observe and Listen

Ask questions, such as:

- Mr. Hudson divides 5 m of ribbon into strips that are one-fourth of a metre long. Will he have more or less than 5 strips?
  (*More than 5 strips*)
- How do you know?
  (*Since each strip is less than 1 m long, there will be more than 5 strips in 5 m.*)

Sample Answers

1. $2 \div 0.2 = 10$

2. $3 \div \frac{1}{6} = 18$

3. a) 32
b) 21
c) 10
d) 48
e) 8
f) 12

4. a) 20
b) 5
c) 50
d) 6
e) 20
f) 35

5. a) Check students' drawings.
b) 10

6. a) Check students' drawings.
b) 40

7. Sample problem: Evan had 9 hectares of land that he divided into lots that measure one-third of a hectare. How many plots did he have?
a) Use $\frac{1}{3}$-strips to form 9 wholes.
b) 27

8. Sample problem: Laura had 4 kg of play sand. She made bags of sand, each with a mass of 0.4 kg. How many bags did she make?
a) Use a flat to represent 1 kg. Divide the 4 flats into groups of 4 tenths. Each group represents 0.4 kg. Count the number of groups. There are 10 groups.
b) Laura made 10 bags of sand.

9. a) ii; 8 **b)** iii;4 **c)** i; 5 **d)** iv; 10

REFLECT: The quotient is greater than both the divisor and the dividend.

Encourage students to compare their answers. Some students may have an answer of 1.2. These students solved the division problem: $5 \div 4$.

Show students the process of dividing a whole number by a decimal, using Base Ten Blocks. Students should use the models and group sets of the divisor. The number of sets is the quotient.

Practice

Assessment Focus: Question 6

Students should draw a model of 8 wholes. They then divide each whole into tenths and circle groups of 2 tenths. Students count the number of groups circled to find that 40 is the quotient.

REACHING ALL LEARNERS

Early Finishers

Students make up their own problem that requires dividing whole numbers by hundredths. They can model the dividend using Base Ten Blocks and make groups equal to the divisor.

Common Misconception

- Students think that the quotient in a division problem is always less than the dividend.

How to Help: Have students use $\frac{1}{2}$-strips. Start with a problem such as $2 \div \frac{1}{2}$. Students can model this problem with 4 fraction strips. The quotient 4 is greater than the dividend 2.

ASSESSMENT FOR LEARNING

What to Look For	What to Do
Knowledge and Understanding √ Students understand how to model the division of a whole number by a fraction and by a decimal. ***Application*** √ Students can divide a whole number by a fraction and by a decimal. ***Communication*** √ Students can describe the process of dividing of a whole number by a fraction or by a decimal.	***Extra Support*:** Students can use Step-by-Step Master 4.46 to complete question 6. ***Extra Practice*:** Have students rewrite each division in question 4 with a fraction as the divisor. Students find each quotient, then check their answers against those they found with the decimal divisors. ***Extension:*** Have students find each quotient: $1 \div \frac{1}{4} =$ $2 \div \frac{1}{4} =$ $3 \div \frac{1}{4} =$ $4 \div \frac{1}{4} =$ Students continue this pattern for dividends from 5 to 10. Then have students make up similar patterns, using other unit fractions and/or non-unit fractions.

Recording and Reporting
Master 4.2 Ongoing Observations: Fractions and Decimals

4.8: Dividing Decimals

Focus Note 4.8

Curriculum expectations: Solve problems involving the multiplication and division of decimal numbers to thousandths by one-digit whole numbers, using a variety of tools and strategies.

Student material: Master 4.47

Curriculum Focus

The curriculum requires that students use a variety of strategies to solve problems involving dividing decimals by one-digit whole numbers.

Extend *Connect*. Provide examples that use the distributive property, such as this:

Example Divide: $32.8 \div 4$

Solution Think: $32.8 \div 4 = (32 + 0.8) \div 4$

$(32 + 0.8) \div 4 = 32 \div 4 + 0.8 \div 4$

$= 8 + 0.2$

$= 8.2$

Have students complete Master 4.47, Dividing Decimals to Thousandths by a Whole Number.

Answers to Master 4.47: 1. Estimates may vary. **a)** 10, 9.84 **b)** 3, 3.02 **c)** 3, 3.2 **d)** 5, 5.009 **e)** 5, 5.26 **f)** 3, 3.097 **2.** 2.6 min **3.** $23.62 **4. a)** 18.47 cm **b)** 46.94 cm **5. a)** 238.1 km **b)** 119.05 km

4.9: Order of Operations with Decimals

Focus Note 4.9

Curriculum expectation: Use a variety of mental strategies to solve problems involving the addition and subtraction of fractions and decimals.

Curriculum Focus

The curriculum requires that students use a variety of strategies to solve problems involving different operations with decimals.

Show students how to use the distributive property to solve *Practice* question 1b:

Think: $14 - 2.2 \times 5 = 14 - (2 + 0.2) \times 5$

$14 - 2.2 \times 5 = 14 - (2 \times 5 + 0.2 \times 5)$

$= 14 - (10 + 1)$

$= 14 - 11$

$= 3$

Have students use this strategy or other mental math strategies to complete similar *Practice* questions.

Name:_____ Date:_____

Master 4.42

Multiplying Decimals to Thousandths by a Whole Number

1. Multiply. Estimate first.

a) 5×3.9

b) 1.18×7

c) 1.051×4

d) 2×9.45

e) 5×1.975

f) 4.814×6

2. A rectangular garden measures 7 m by 8.6 m. What is the area of the garden?

3. Cassandra swims one lap in 72.24 s.
At the same rate, how long will it take Cassandra to swim 4 laps?

4. Kim drives 31.4 km to work each day. She drives the same distance home.

a) How far does Kim drive to and from work each day?

b) How far does Kim drive in a 5-day workweek?

5. **a)** Gabe receives $1.15 allowance each day.
How much money does Gabe receive in one week?

b) Helen receives $1.75 allowance each day.
How much more money does Helen get in one week?

Name:_____ Date:_____

Master 4.43

4.7A Dividing Whole Numbers by Fractions and Decimals

Division can be thought of in two ways: dividing by grouping and dividing by sharing.

Explore

Work with a partner.
You will need fraction strips and a number line.
Mr. Hudson bought 5 m ribbon.
He cut the ribbon into pieces that are each one-fourth of a metre long.
Find the number of pieces.

- Show how to find the number of pieces using a number line and fraction strips.

Reflect & Share

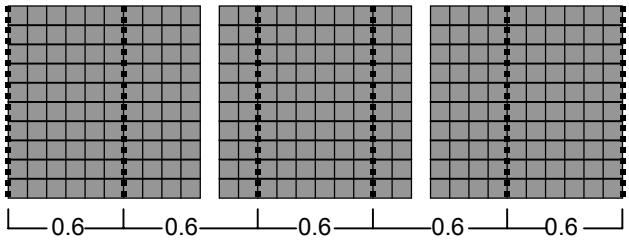
Compare your answer to the problem with those of other classmates.
Did you get the same answer? Explain.

Connect

In Explore, you used fraction strips to divide a whole number by a fraction.
You can use Base Ten Blocks to divide a whole number by decimals. For example, divide 3 by 0.6:

Use 3 flats to represent 3 ones.
Each flat is divided into 10 rods.
Each rod is 0.1.

Make groups of 0.6.
Count the number of groups.
There are 5 groups.
So, $3 \div 0.6 = 5$



Example ----------

Rana cut each of 5 bananas into thirds. How many slices of banana did she get?

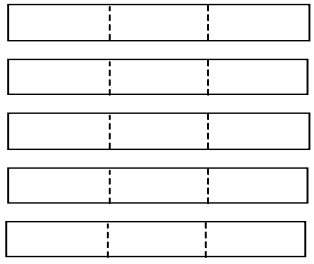
Solution

Use fraction strips. Show 5 wholes.

Divide each whole into thirds. Count the $\frac{1}{3}$-strips.

There are 15. So, $5 \div \frac{1}{3} = 15$

Rana got 15 slices of banana.



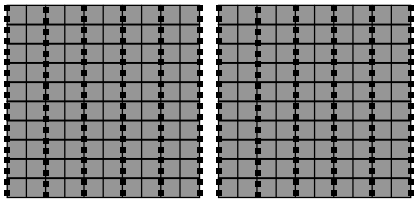
Name:_____ Date:_____

Master 4.44

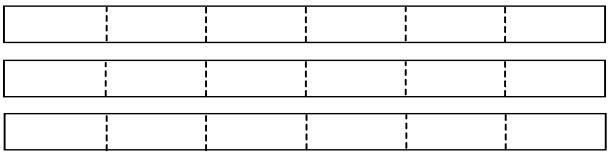
Section 4.7A Continued

Practice

1. Write a division sentence for this picture.
The divisor is a decimal. A flat represents 1.



2. Write a division sentence for this picture.
The divisor is a fraction.



3. Use fraction strips to find each quotient.

a) $8 \div \frac{1}{4}$ **b)** $7 \div \frac{1}{3}$ **c)** $2 \div \frac{1}{5}$

d) $6 \div \frac{1}{8}$ **e)** $4 \div \frac{1}{2}$ **f)** $1 \div \frac{1}{12}$

4. Use Base Ten Blocks to find each quotient.

a) $6 \div 0.3$ **b)** $4 \div 0.8$ **c)** $5 \div 0.1$

d) $3 \div 0.06$ **e)** $8 \div 0.04$ **f)** $2 \div 0.05$

5. Natalie drives 5 km to work. There are traffic lights every half kilometre.

a) Draw fraction strips to model the problem.

b) How many traffic lights are there on Natalie's trip to work?

6. **Assessment Focus** Bruce jogs 8 km each day at the park.
There is a tree every 0.2 km.

a) Draw Base Ten Blocks to model the problem.

b) How many trees does Bruce pass when he jogs each day?

7. Write a word problem that can be solved by dividing a whole number by a fraction.

a) Explain how to model the problem using fraction strips.

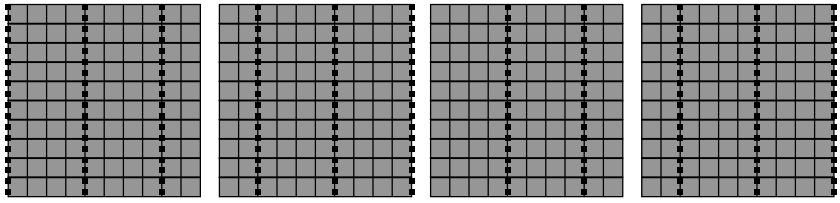
b) What is the answer to your word problem?

Name:_____ Date:_____

Master 4.45

Section 4.7A Continued

8. Use Base Ten Blocks below.
Write a word problem that can be solved by dividing a whole number by a decimal.



a) Explain how to solve the problem using Base Ten Blocks.
b) What is the answer to your word problem?

9. Match each division problem with the correct model.
Then find the quotient.

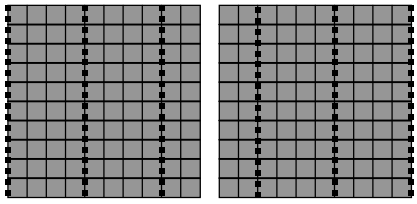
a) $2 \div \frac{1}{4}$

b) $2 \div 0.5$

c) $2 \div 0.4$

d) $2 \div \frac{1}{5}$

i)



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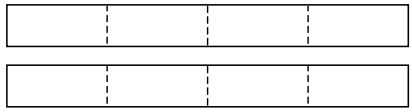

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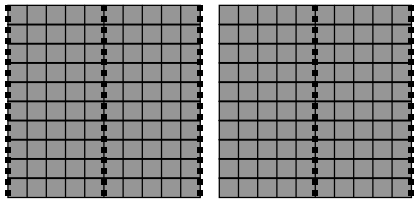

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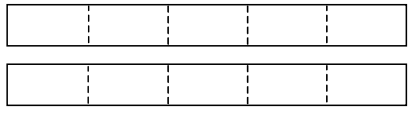


Reflect

When a whole number is divided by a fraction less than 1,
how does the quotient compare with the divisor and dividend?

Name:_____ Date:_____

Master 4.46

Step-by-Step 7A

Section 4.7A, Question 6

Step 1 Sketch 8 flats, each with 100 small squares.
Divide each flat into 10 rods.

Step 2 Each rod is 0.1 km.
Circle groups of 0.2 km.

Step 3 How many groups of 0.2 km are there?

_____

How many trees does Bruce pass each day?

_____

Name:_____ Date:_____

Master 4.47

Dividing Decimals to Thousandths by a Whole Number

1. Divide. Estimate first.

a) 19.68 ÷ 2 **b)** 9.06 ÷ 3 **c)** 12.8 ÷ 4

d) 45.081 ÷ 9 **e)** 31.56 ÷ 6 **f)** 15.485 ÷ 5

2. Teresa ran 6 laps in 15.6 min.
What was the average time for one lap?

3. Jim has $94.48. He plans to go shopping 4 times and spend the same amount of money each time.
How much money will Jim spend on each shopping trip?

4. The area of a rectangle is 92.35 cm^2. Its length is 5 cm.

a) What is the width of the rectangle?

b) What is the perimeter of the rectangle?

5. Alejandro drives 1666.7 km per week on his 7-day per week delivery route.

a) How far does Alejandro drive per day?

b) Alejandro drives the same distance every day before lunch and after lunch.
How far does he drive every day before lunch?

Unit 5 Data Management

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Optional but recommended	
5.1: Collecting Data	Required: see Focus Note 5.1	
Technology: Using Databases to Find Data	Required	
5.2: Recording Data	Required	
5.3: Stem-and-Leaf Plots	Required	
Technology: Using *Fathom* to Investigate Scatter Plots	Required	
5.4: Line Graphs	Required	
Technology: Using Spreadsheets to Record and Graph Data	Required	
5.5: Applications of Mean, Median, and Mode	Required: see Focus Note 5.5	Master 5.22
5.6: Evaluating Data Analysis	Required	
Unit Problem: Organizing a Winter Carnival	Required	

Skills You'll Need: Although this material is not directly required by your curriculum, the material is recommended as a prerequisite for the sections in this Unit.

5.1: Collecting Data

Focus Note 5.1

Curriculum expectation: Distinguish between a census and a sample from a population.

Curriculum Focus

The curriculum requires that students distinguish between a census and a sample from a population.

When you introduce the lesson, provide students with the following definitions:
Census – the count of a population
Sample – a representative part of a population

Tell students that a census considers the data for an entire population, while a sample considers the data for part of a population. The results of a survey conducted on a sample of a population are used to make predictions about the population.

Have students suggest why Statistics Canada only collects census information every five years.

5.5: Applications of Mean, Median, and Mode

Focus Note 5.5

Curriculum expectation: Determine, through investigation, the effect on a measure of central tendency (i.e., mean, median, mode) of adding or removing a value or values.

Student material: Master 5.22

Curriculum Focus

The curriculum requires that students can determine the effect on a measure of central tendency of adding or removing a value or values.

Have students work on Master 5.22, The Effects of Outliers. Students should discover that changing the value of an outlier may have a significant effect on the mean but not on the median.

Discuss how this effect has changed some practice in our daily lives, such as calculating the mean score after removing an outlier.

Answers to Master 5.22:

1. a) mean = 78, median = 74.5 **b)** mean = 70, median = 74; the mean changes more

2. a) mean = 111, median = 111, mode = 111 **b)** mean = 128.5, median = 111.5, mode = 111
c) The mean changes the most.

3. a) mean = 85, median = 89 **b)** The mean increases by 5.5 and the median increases by 1
c) mean = 85, median = 88.5

4. a) mean = 12, median = 10.5, no mode **b)** The mean decreases by 2.4, the median decreases by 0.5, and there is still no mode. **c)** mean = 12; median = 11; mode = 12

5. Answers may vary. In most diving competitions, the mean is used as the final score. Removing the extreme scores ensures that the mean represents a diver's overall performance, and allows for judges who may be biased.

Name:_____ Date:_____

Master 5.22

The Effects of Outliers

1. Use these data: 67, 89, 74, 89, 75, 74

a) Find the mean and median of the data.

b) When 22 is added to the data, which changes more, the mean or the median?

2. Use these data: 95, 111, 112, 126, 111

a) Find the mean, median, and mode of the data.

b) Suppose 216 is included in the data. What are the new mean, median, and mode?

c) When 216 is included in the data, which changes the most: the mean, the median, or the mode?

3. Garrett received these marks on 5 tests: 89, 91, 94, 88, 63

a) Find the mean and median marks.

b) What happens to the mean and median if Garrett's lowest mark is not included?

c) Garrett's mark on the 6th test is 85. What are the new mean and median marks?

4. Rae scored 8 points, 12 points, 11 points, 7 points, 10 points, and 24 points in her basketball games played this year.

a) Find the mean, median, and mode points scored.

b) What happens to the mean, median, and mode if Rae's highest score is not included?

c) Rae's score for the next game is 12 points. What are the new mean, median, and mode?

5. At a diving competition, the highest and lowest scores from 10 judges are not included in calculating the average score for each diver's performance. Explain why.

Unit 6 Measuring Perimeter and Area

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Optional but recommended	
6.1: Area of a Parallelogram	Required	
6.2: Area of a Triangle	Optional	
6.3: Area and Perimeter of a Trapezoid	Required: see Focus Note 6.3	
6.4: Measuring Irregular Figures	Required	
6.4A: Volume of a Right Prism **Curriculum expectations:** Sketch different polygonal prisms that share the same volume. Determine, through investigation using a variety of tools and strategies, the relationship between the height, the area of the base, and the volume of right prisms with simple polygonal bases, and generalize to develop the formula. Solve problems that involve the surface area and volume of right prisms and that require conversion between metric measures of capacity and volume.	Required	Masters 6.22 to 6.25 Step-by Step 4A: Master 6.26 Pattern Blocks, rulers
6.4B: Surface Area of a Right Prism **Curriculum expectations:** Solve problems that require conversion between metric units of area. Determine, through investigation using a variety of tools, the surface area of right prisms.	Required	Masters 6.27 to 6.29 Step-by Step 4B: Master 6.30 Pattern Blocks, masking tape
Unit Problem: Designing a Patio	Required	

Skills You'll Need: Although this material is not directly required by your curriculum, the material is recommended as a prerequisite for the sections in this Unit.

Section 6.2: The material in this section is not required by the Grade 7 curriculum. However, this lesson should be taught in the first year of implementation to accommodate students' transition to the new curriculum.

6.3: Area and Perimeter of a Trapezoid

Focus Note 6.3

Curriculum expectation: Determine, through investigation using a variety of tools and strategies, the relationship for calculating the area of a trapezoid, and generalize to develop the formula [i.e., *Area* = (*sum of lengths of parallel sides* × *height*) ÷ 2]

Curriculum Focus

The curriculum requires that students develop the formula for calculating the area of a trapezoid.

Practice question 10 provides an opportunity for students to develop a formula for finding the area of a trapezoid. See Teacher Guide notes, Unit 6, page 17, question 10, for an explanation of how the formula is developed.

SECTION 6.4A

6.4A Volume of a Right Prism

Curriculum expectations: Sketch different polygonal prisms that share the same volume. Determine, through investigations using a variety of tools and strategies, the relationship between the height, the area of the base, and the volume of right prisms with simple polygonal bases, and generalize to develop the formula. Solve problems that involve the surface area and volume of right prisms and that require conversion between metric measures of capacity and volume.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Determine the relationship between the height, the area of the base, and the volume of right polygonal prisms.

Student Materials
- Masters 6.22, 6.23, 6.24, 6.25
- Pattern Blocks
- ruler

Optional
- Step-by-Step 4A (Master 6.26)

Assessment: Master 6.2 Ongoing Observations: Measuring Perimeter and Area

Key Math Learnings

1. The volume of a right polygonal prism can be found using the formula $V = A \times h$, where V is the volume, A is the area of the base, and h is the height of the prism.
2. A volume of one 1 cm^3 is equal to a capacity of 1 mL.
3. Different polygonal prisms may have the same volume.

BEFORE Get Started

Review the formulas for the areas of polygons such as rectangles, squares, trapezoids, parallelograms, and triangles.

Present *Explore*. Remind students that the two bases of a prism are congruent.

DURING Explore

Ongoing Assessment: Observe and Listen

Ask questions, such as:
- What is the shape of the base of the prism that you are building? (*Trapezoid*)
- How do you find the area of the base? (*Divide the trapezoid into smaller figures: 2 triangles and 1 rectangle, or 1 triangle and 1 parallelogram, or 2 triangles*)

Sample Answers

1. a) 4 cm^2; 24 cm^3
b) 90 m^2; 1350 m^3
c) 22.5 m^2; 216 m^3

2. a) 24 cm^2
b) 192 cm^3

3. Possible prisms may be a hexagonal prism made with 4 Pattern Blocks, a trapezoidal prism made with 8 Pattern Blocks, and a triangular prism made with 24 Pattern Blocks.

4. a) 23 m^2
b) 5 m

5. a) 54 m^2
b) 432 m^3
c) A prism has 2 congruent bases. The base of the prism is a triangle whereas the base of the tent is a rectangle.

6. a) 180 m^3
b) Check students' sketches.
c) 90 m^3
d) Divide the volume of the rectangular prism by 2.
e) 18 m
f) 540 m^3

REFLECT: Two prisms that have the same volume may not have the same height. If the prisms do have the same height, then they will have the same base area. The prisms may not be congruent. One could be a triangular prism, while the other could be a hexagonal prism.

AFTER — Connect

Encourage students to share their formulas. Have them explain the formulas in their own words.

Ask students to find other prisms that have the same volume as their trapezoidal prism made with 6 Pattern Blocks. (*A parallelogram prism that is 9 blocks tall or a triangular prism that is 18 blocks tall*)

Practice

Have Pattern Blocks available for question 3.

Assessment Focus: Question 4

Some students may realize they divide the volume by the height to get the base area, and they divide the volume by the base area to get the height. Other students may use guess and check.

REACHING ALL LEARNERS

Common Misconception

- Students cannot identify the base of a right prism when the base is not horizontal.

How to Help: Have students identify the two non-rectangular faces that are congruent. These faces are the bases of the prism. For rectangular prisms, any two opposite faces are the bases.

Early Finishers

Have students write and solve a problem that involves the volume of a right polygonal prism. Students trade problems with a classmate. Students solve their classmate's problem and compare answers.

ASSESSMENT FOR LEARNING

What to Look For	What to Do
Knowledge and Understanding √ Students understand that the volume of a right prism is the product of its base area and height. ***Application*** √ Students can apply the formula to find the volume of a prism. √ Students can find the base area of a right polygonal prism given its volume and height, and find the height given the volume and base area. ***Communication*** √ Students can describe how one prism may have the same volume as different prism.	***Extra Support*:** Student can use Step-by-Step Master 6.26 to complete question 4. ***Extra Practice*:** Have students use the orange Pattern Blocks to make a right square prism. They can repeat *Explore* and compare their answers with their previous work from Section 3.6. ***Extension:*** Repeat *Explore*. Find the volume of a stack of 5 tan Pattern Blocks.

Recording and Reporting
Master 6.2 Ongoing Observations: Measuring Perimeter and Area

SECTION 6.4B

6.4B Surface Area of a Right Prism

Curriculum expectations: Determine, through investigation using a variety of tools, the surface area of right prisms. Solve problems that involve the surface area and volume of right prisms and that require conversion between metric measures of capacity and volume.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Determine the surface areas of right prisms.

Student Materials
- Masters 6.27, 6.28, 6.29
- Pattern Blocks
- masking tape

Optional
- Step-by-Step 4B (Master 6.30)

Assessment: Master 6.2 Ongoing Observations: Measuring Perimeter and Area

Key Math Learnings
1. The surface area of a right prism is the sum of the areas of the faces of the prism.
2. An area of 1 m^2 = 10 000 cm^2
3. The number of rectangular faces is equal to the number of edges on a base.

BEFORE — Get Started

Present *Explore*. Remind students that, for right prisms, the two bases are congruent. The other faces are rectangles.

DURING — Explore

Ongoing Assessment: Observe and Listen

Ask questions, such as:
- What is the shape of the base of the prism that you are building? (*Trapezoid*)
- What are the shapes of the other faces of the prism? (*Rectangles*)
- Which faces have the same areas? (*Top and bottom and the two opposite sides*)

Observe to see if students realize that they need only find the areas of 4 faces of the prism because 2 pairs of faces have equal areas.

Sample Answers

1. 2 × 26 cm^2 + 6 × 10 cm^2 = 112 cm^2

2. a) Each triangular face: 6 cm^2
Rectangular faces (from left to right): 6 cm^2, 8 cm^2, 10 cm^2
b) The 2 triangular faces
c) 36 cm^2

3. a) 2038.5 cm^2
b) 0.203 85 m^2

4. a) Check students' nets.
b) Top: 4326 cm^2; bottom: 3780 cm^2; left: 126 cm^2; right: 2268 cm^2; front: 2565 cm^2; back: 2565 cm^2
c) 15 630 cm^2

5. a) Check students' nets.
b) Check students' drawings.
c) Check students' drawings.
d) 39.84 m^2; the actual area will be less because this area includes the areas of doors and windows

REFLECT: Determine which faces have equal areas. Find the dimensions of those faces. Find the area of each face, then add the areas. The two bases are congruent, so I need only find the area of one base, then double the answer to find the area of the two bases. I can do the same with the other faces if pairs of them are congruent.

AFTER Connect

Students' formulas for the surface area could be:
Surface area = sum of the areas of the faces
Surface area = 2 × area of top face + 2 × area of side face + area of front face + area of back face
Surface area = 2 × (area of top face + area of side face) + area of front face + area of back face

Have students find examples of prisms in the classroom for which the surface area can be calculated without finding the area of each face.

Practice

Assessment Focus: Question 4

Students need to realize that the ramp is a right trapezoidal prism. It is positioned so that the congruent bases are vertical. Students use a formula for the area of the trapezoid to find the area of a base. The other 4 faces are rectangles, for which the dimensions are given.

REACHING ALL LEARNERS

Common Misconception

- When students calculate the surface area of volume, they do not know if the units should be square units or cubic units.

How to Help: Remind students that, to calculate surface area, they multiply two lengths. If the lengths are in centimetres, the units of surface area are square centimetres (cm^2). When students calculate volume, they multiply three lengths. The units of volume are cubic centimetres (cm^3).

Early Finishers

Have students repeat *Explore* for different Pattern Blocks.

ASSESSMENT FOR LEARNING

What to Look For	What to Do
Knowledge and Understanding √ Students understand that the surface area of a prism is the sum of the areas of its faces. ***Application*** √ Students can identify the congruent faces of a prism. √ Students can use the concept of congruent faces to find the surface area of a prism without finding the areas of all the faces. ***Communication*** √ Students can describe how to find the surface area of a right prism.	***Extra Support*:** Student can use Step-by-Step Master 6.30 to complete question 4. ***Extra Practice*:** Have students measure the dimensions of different right prisms in the classroom. Students then calculate the surface areas of these prisms.

Recording and Reporting
Master 6.2 Ongoing Observations: Measuring Perimeter and Area

Name:_____ Date:_____

Master 6.22

6.4A Volume of a Right Prism

Explore

Work with a group.
You will need Pattern Blocks and a ruler.
The red Pattern Block is a **right prism** with a base that is a trapezoid.

In a right prism, all faces, other than the polygonal bases, are rectangular.

- Find the height and the area of the base of a red Pattern Block.
  Calculate the volume of the block.
  Record your data in this table.

Number of Blocks	Height of Prism (cm)	Area of Base (cm^2)	Volume of Prism (cm^3)
1			
2			
3			
4			
5			
6			

- Stack a second red block.
  Find the new height and the new volume.
  Record your data in the table.
- Continue to stack blocks and complete the table.
- Write a formula you can use to find the volume of a right trapezoidal prism.
- Use two stacks of 3 red Pattern Blocks to make a right prism with a base that is a regular hexagon.
- Compare the volumes of the trapezoidal prism with a height of 6 Pattern Blocks and the hexagonal prism with a height of 3 Pattern Blocks.
  What do you notice?

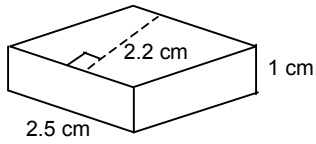
Reflect & Share

Compare your formula with those of other groups. What do you notice?
Is there another way to find the volume of a right prism? Explain.

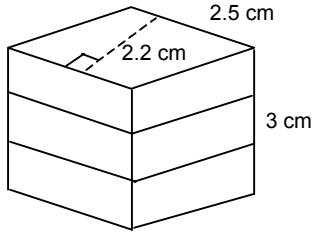
Section 6.4A Continued

Connect

A blue Pattern Block has a parallelogram base.
The area of the parallelogram is:
base × height = 2.5 cm × 2.2 cm = 5.5 cm^2
The height of the blue block is 1 cm,
so the volume of the block is: 5.5 cm^2 × 1 cm = 5.5 cm^3



A right prism built using 3 blue Pattern Blocks has base area:
2.5 cm × 2.2 cm = 5.5 cm^2
The height of the prism is 3 cm, so the volume of the prism is:
5.5 cm^2 × 3 cm = 16.5 cm^3



The volume of a right prism is:
Volume = base area × height, or $V = A \times h$

When the volume and the base area of a right prism are known, we can find the height of the prism.

Example

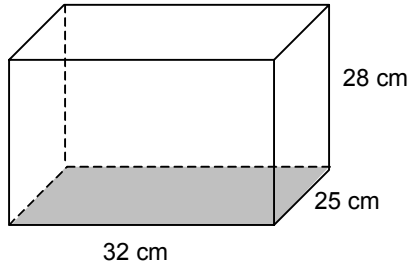
Adam's fish tank has a rectangular base. Its dimensions are 32 cm by 25 cm.
The height of the fish tank is 28 cm.

a) What is the volume of Adam's fish tank?
What is its capacity in millilitres? In litres?

b) Jenna's fish tank has the shape of a hexagonal prism. It has the same volume as Adam's fish tank. The height of Jenna's fish tank is 16 cm.
What is the area of the base of Jenna's fish tank?

Solution

a) Sketch Adam's fish tank.
Label each dimension.
The base is a rectangle.
Find the area of the rectangle:
32 cm × 25 cm = 800 cm^2
Multiply the area of the base by the height:
800 cm^2 × 28 cm = 22 400 cm^3
The volume of Adam's fish tank is 22 400 cm^3.
Since 1 cm^3 = 1 mL, the capacity of the tank is 22 400 mL.
Since 1000 mL = 1 L, the capacity of the tank is 22.4 L.



Name:_____ Date:_____

Master 6.24

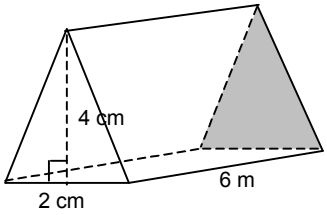
Section 6.4A Continued

b) Use the formula for the volume of a right prism: $V = A \times h$
The volume of Adam's fish tank is 22 400 cm^3.
The height of Jenna's fish tank is 16 cm.
Substitute $V = 22\,400$ and $h = 16$.
$22\,400 = A \times 16$
Think: What do we multiply 16 by to get 22 400?
Use the inverse operation. Divide: $22\,400 \div 16 = 1400$
Then, $22\,400 = 1400 \times 16$
So, $A = 1400$
The area of the base of Jenna's fish tank is 1400 cm^2.

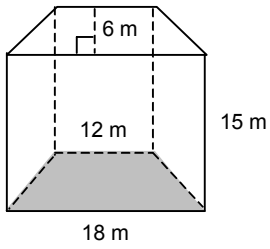
Practice

1. For each right prism, find the area of its base, then find its volume.

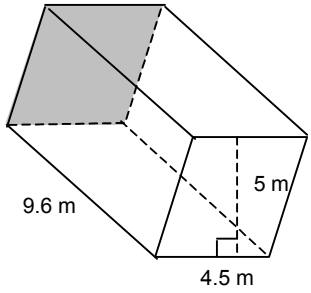
a)



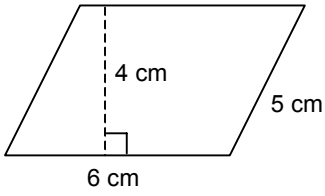
b)



c)



2. The base of a right prism is a parallelogram.
The height of the prism is 8 cm.



a) Find the area of the base of the prism.
b) Find the volume of the prism.

3. Use Pattern Blocks.
a) Construct 3 different right prisms with the same volume.
Sketch each prism you made. Label its dimensions.
b) How do you know the volumes are equal?

Section 6.4A Continued

4. **Assessment Focus** A right triangular prism has volume 575 cm^3.
A right trapezoidal prism has the same volume as the triangular prism.

a) The height of the trapezoidal prism is 25 cm.
What is the area of its base?

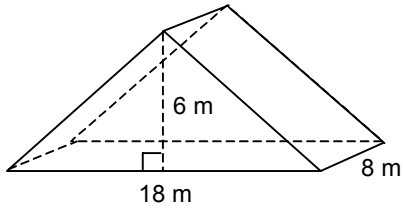
b) The area of the base of the triangular prism is 115 cm^2.
What is its height?

5. A tent has the shape of a right prism with a triangular base.

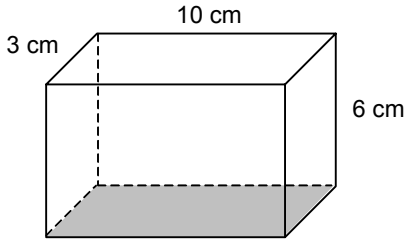
a) Find the area of the base of the prism.

b) Find the volume of the tent.

c) Why is the base of the prism not the base of the tent?



6. This right prism has a rectangular base.



a) Find the volume of the prism.

b) Suppose the prism is cut in half along a diagonal to make 2 triangular prisms.
Sketch the triangular prisms.

c) What is the volume of each triangular prism?

d) Explain how you found the volume of each triangular prism.

e) Suppose the height of the rectangular prism is tripled.
What is the height of the new prism?

f) What is the volume of the new prism?

Reflect

Suppose two right prisms have the same volume.
Do they have the same height? Explain.

Name:_____ Date:_____

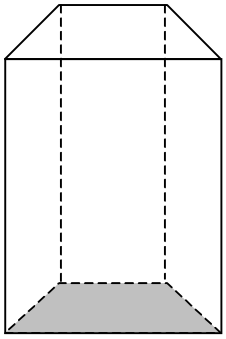
Master 6.26

Step-by-Step 4A

Section 6.4A, Question 4

Step 1 Name each prism.
Label the measurements you know.

_____ **prism**

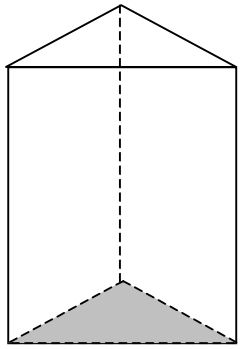


Height =

Base area =

Volume =

_____ **prism**



Height =

Base area =

Volume =

Step 2 Use the formula for the volume of a right prism:
Volume = base area × height
Complete this table for the prisms in Step 1.

Prism	Volume	Base Area	Height
Trapezoidal			
Triangular			

Step 3 What is the base area of the trapezoidal prism?

_____

What is the height of the triangular prism?

_____

Master 6.27

6.4B Surface Area of a Right Prism

Explore

Work with a group.
You will need Pattern Blocks and a ruler.

- Use trapezoidal Pattern Blocks to build a right trapezoidal prism.
- Find the area of each face of your prism. Record the areas in the table.
- Add the areas.
- Write a formula to find the surface area of a right prism.

Face	Area (cm^2)
Front	
Back	
Left	
Right	
Top	
Bottom	

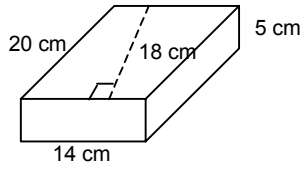
Reflect & Share

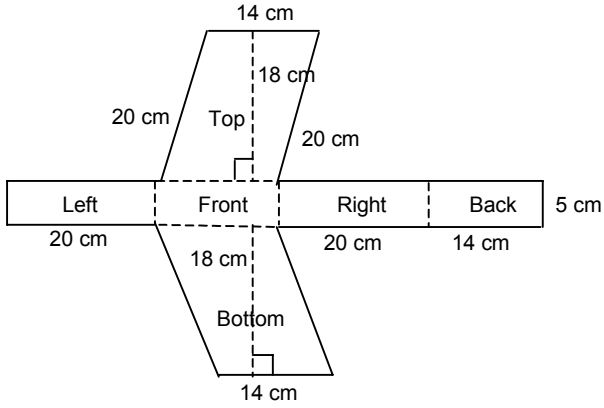
Compare your formula with those of other groups.
Are there ways to simplify the formula? Explain.

Connect

A net is a pattern that folds to make an object.
A net shows each face of the object.
The surface area of a prism is the sum of the areas of its faces.
So, a net of the prism can be used to find the surface area of the prism.

Here is a right prism with parallelogram bases and below is a net of the prism.





To find the surface area of this prism, first find the area of each face.
Top face: $14 \times 18 = 252$
Left face: $20 \times 5 = 100$
Front face: $14 \times 5 = 70$
Right face: $20 \times 5 = 100$
Back face: $14 \times 5 = 70$
Bottom face: $14 \times 18 = 252$

Add the areas of the faces:
$70 + 70 + 100 + 100 + 252 + 252 = 844$
The surface area of the prism is 844 cm^2.

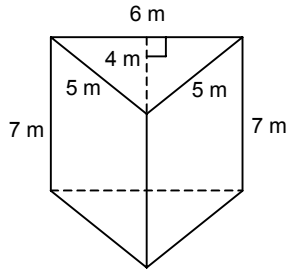
Name:_____ Date:_____

Master 6.28

Section 6.4B Continued

Example ----------

Find the surface area of this right triangular prism.
What is the surface area in square centimetres?



Solution

Draw a net.
Find the area of each face.
The area of each triangular face is:

$\frac{1}{2} \times 6 \times 4 = 12$

The areas of the 3 rectangular faces are:

$5 \times 7 = 35$ $6 \times 7 = 42$ $5 \times 7 = 35$

The surface area of the prism is:

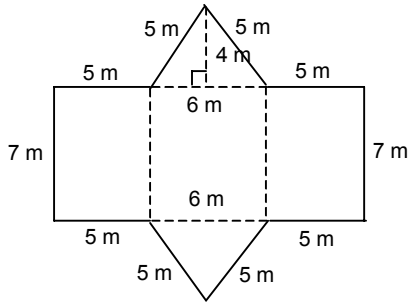
$12 + 12 + 35 + 42 + 35 = 136$

The surface area of the prism is 136 m^2.

$1\ m^2 = 10\ 000\ cm^2$

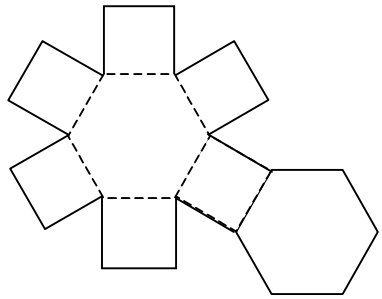
So, the surface area of the prism is:

$136 \times 10\ 000\ cm^2 = 1\ 360\ 000\ cm^2$



Practice

1. Here is a net of a right prism, with bases that are regular hexagons.
All the other faces are squares.
The area of each base is about 26 cm^2.
The area of each square face is about 10 cm^2.
What is the approximate surface area of the prism?

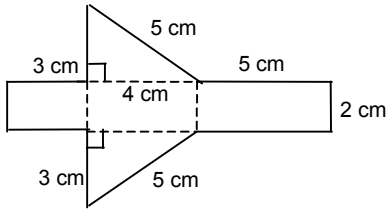


2. The net shows the dimensions of a right triangular prism.

a) Find the area of each face.

b) Which faces have the same area?

c) What is the surface area of the prism?

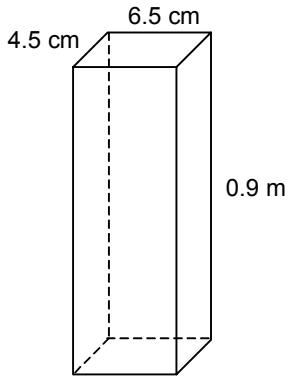


Section 6.4B Continued

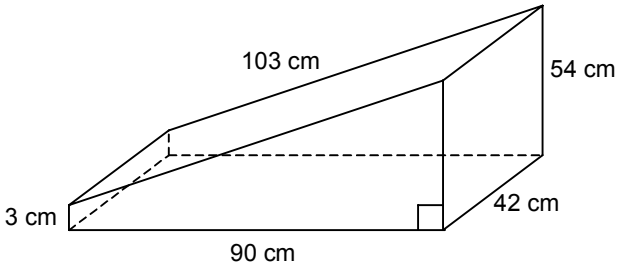
3. Gwen painted the surface of this rectangular prism.

a) Find the surface area of the prism in square centimetres.

b) Find the surface area of the prism in square metres.



4. **Assessment Focus** The dimensions of a ramp are shown below.



a) Sketch a net of the ramp with the dimensions shown.

b) Find the area of each face.

c) What is the surface area of the ramp?

5. Katie is hanging wallpaper in her bedroom.
The dimensions of the floor are 3.7 m by 4.6 m.
The height of the room is 2.4 m.
Katie will not put wallpaper on the ceiling or on the floor.

a) Sketch a net of Katie's bedroom.

b) Label the dimensions of the bedroom.

c) Shade the sections Katie will put wallpaper.

d) How much wallpaper will Katie use? What assumptions do you make?

Reflect

Explain how to find the surface area of a right prism.

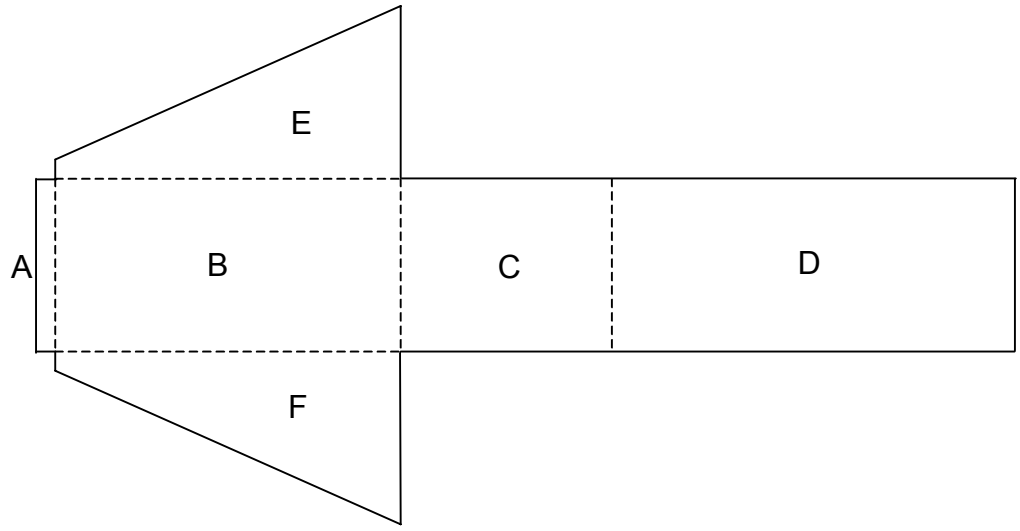
Name:_____ Date:_____

Master 6.30

Step-by-Step 4B

Section 6.4B, Question 4

Step 1 Here is the net for the ramp.
Label all the dimensions.



Step 2 Find the area of each face.

Face A = _____

Face B = _____

Face C = _____

Face D = _____

Face E = _____

Face F = _____

Step 3 Add the areas in Step 2. _____

What is the surface area of the ramp? _____

Unit 7 Geometry

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Optional but recommended	
7.1: Classifying Figures	Required	
Technology 7.1A: Using a Computer to Construct Related Lines and Angle Bisectors **Curriculum expectations:** Construct related lines using angle properties and a variety of tools. Construct angle bisectors and perpendicular bisectors, using a variety of tools and strategies, and represent equal angles and equal lengths using mathematical notation.	Required	Masters 7.26 to 7.28 *The Geometer's Sketchpad*, rulers, compasses, protractors
7.2: Congruent Figures	Required: see Focus Note 7.2	grid paper
7.2A: Similar and Congruent Figures **Curriculum expectation:** Distinguish between and compare similar shapes and congruent shapes, using a variety of tools and strategies.	Required	Masters 7.29 to 7.32 Step-by Step 2A: Master 7.33 Tangram triangles, rulers, protractors
Technology 7.2B: Dilatations **Curriculum expectation:** Identify, perform, and describe dilatations, through investigation using a variety of tools.	Required	Masters 7.34 to 7.35 *The Geometer's Sketchpad*, rulers, grid paper, geoboards
7.3: Transformations	Required	
7.4: Tiling Patterns	Required	
7.5: Using Transformations to Make Designs	Required	
Technology: Using a Computer to Transform Figures	Required	
7.5A: Sorting Triangles and Quadrilaterals by Their Properties **Curriculum expectation:** Sort and classify triangles and quadrilaterals by geometric properties related to symmetry, angles, and sides, through investigation using a variety of tools and strategies.	Required	Masters 7.36 to 7.39 Step-by Step 5A: Master 7.40
Unit Problem: Tessellations	Required	
Cross Strand Investigation: Pick's Theorem	Required	

Skills You'll Need: Although this material is not directly required by your curriculum, the material is recommended as a prerequisite for the sections in this Unit.

SECTION 7.1A

Technology: Using a Computer to Construct Related Lines and Angle Bisectors

Curriculum expectation: Construct related lines, using angle properties and a variety of tools and strategies.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Construct related lines, using angle properties and a variety of tools.

Student Materials

- Masters 7.26, 7.27, 7.28
- *The Geometer's Sketchpad*
- rulers
- compasses
- protractors

Key Math Learning

Computer software, such as *The Geometer's Sketchpad*, can be used to construct related lines and angle bisectors.

BEFORE — Get Started

Tell students that they will use software to construct parallel lines, perpendicular lines, and lines that intersect at 30°, 45°, and 60°. They will also use the software to construct angle bisectors and perpendicular bisectors.

Discuss how a computer can be used to construct lines. Elicit that the software uses programming to ensure an accurate construction.

DURING — Explore

Ongoing Assessment: Observe and Listen

Watch to ensure students understand and follow the directions carefully.

Suggestions for Alternative Construction without Software

Students will need a ruler, protractor, and compass.

Constructing parallel lines

1. Draw a line. Label it m.
2. Mark a point not on the line. Label the point P.
3. Draw a line through point P that intersects line m. Label the line n and the point of intersection Q.
4. Place the compass point on Q. Draw an arc that intersects line n between P and Q, and line m. Label the intersection of line m and this arc, point S. Label the intersection of line n and this arc, point T.
5. Without changing the setting on the compass, place the compass point on P and draw another arc that intersects line n. Label the intersection of line n and this arc, point U.

6. Set the compass to the length of the distance between P and S. Place the compass point on Q and draw an arc that intersects the arc you drew in Step 5. Label the point of intersection of the arcs, point X.
7. Join PX. Line PX is parallel to line *m*.

Constructing perpendicular lines

1. Draw a line. Label it *a*.
2. Mark a point on the line. Label the point B.
3. Place the compass point on point B. Draw an arc that intersects line *a* in two places. Label the points of intersection point C and point D.
4. Set the compass to a length greater than one-half the length of CD. From point C, draw an arc above and below line *a*. Draw a similar arc from point D above and below line *a*. Label the intersections of the arcs, point E and point F.
5. Join EF. Line EF is perpendicular to line *a*.

Constructing lines that intersect at 30°, 45°, and 60°

1. Draw a line. Label it *r*.
2. Mark a point on the line. Label the point G.
3. Place the baseline of a protractor along line *r*, with the centre point on point G.
4. Mark a point at the desired angle measure from the 0 mark of the protractor. Label it point H.
5. Join GH. Line GH intersects line *r* at the desired angle.

Constructing angle bisectors

1. Draw ∠JKH.
2. Place the compass point on K. Draw an arc that intersects both arms of the angle. Label the points of intersection M and N.
3. Set the compass to a length greater than one-half the length of MN. Draw an arc from point M inside the angle. Use the same compass setting. Draw an arc from point N inside the angle. Label the point of intersection of the arcs, Q.
4. Join KQ. Line KQ is the bisector of ∠JKH.

Constructing perpendicular bisectors

1. Draw a line segment. Label it XY.
2. Set the compass to a length greater than one-half the length of XY. Draw an arc from point X above and below the segment. Use the same compass setting. Draw an arc from point Y above and below the segment. Label the points of intersection of the arcs, A and B.
3. Join AB. Line AB is the perpendicular bisector of line segment XY.

AFTER — Connect

Students should show their constructions to a classmate who will check that the lines constructed are parallel, perpendicular, make angles of 30°, 45°, and 60°, or bisect an angle or a line segment as intended.

REACHING ALL LEARNERS

Early Finishers
Have students use the constructions to draw a right triangle, a square, a parallelogram, a trapezoid with one angle of 30° and one of 60°, and so on.

7.2: Congruent Figures

Focus Note 7.2

Curriculum expectation: Determine, through investigation using a variety of tools, relationships among area, perimeter, corresponding side lengths, and corresponding angles of congruent shapes.

Student material: grid paper, isometric paper

Curriculum Focus

The curriculum requires students to relate the areas of congruent figures, and their perimeters.

Have students use grid paper or isometric paper to draw 2 congruent figures, then calculate the area and perimeter of each figure. Students then compare results. If enough different figures have been drawn, students can infer that congruent figures have equal areas and equal perimeters.

SECTION 7.2A

7.2A Similar and Congruent Figures

Curriculum expectations: Distinguish between and compare similar shapes and congruent shapes using a variety of tools and strategies.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Distinguish between similar figures and congruent figures.

Student Materials
- Masters 7.29, 7.30, 7.31, 7.32
- Tangram triangles
- rulers
- protractors

Optional
- Step-by-Step 2A (Master 7.33)

Assessment: Master 7.2 Ongoing Observations: Geometry

Key Math Learnings

1. Similar figures have corresponding angles equal.
2. Similar figures have ratios of pairs of corresponding sides equal.
3. For two figures to be similar, the corresponding angles of the figures must be equal and pairs of corresponding sides must be in the same ratio.

BEFORE Get Started

Remind students that two figures are congruent if corresponding angles are equal and corresponding sides are equal.

Introduce the concept of similar figures. Use the figures on the student pages or draw similar figures on the overhead projector.

BEFORE Get Started

Ongoing Assessment: Observe and Listen

As students work, ask,

- How do you know that these triangles have the same shape? (*When I place one on top of another so that two vertices coincide, I see that the angles at these vertices are equal.*)
- How do you know that these triangles are congruent? (*When I place one on top of another, the triangles coincide.*)

Elicit that congruent triangles are similar because they have the same shape. However, similar triangles are not congruent because they do not coincide.

Sample Answers

1. The blue rhombuses, tan rhombuses, green triangles, and red squares, but not the yellow hexagons and red trapezoids, can combine to make a similar larger figure.

2. a) The triangles are similar because corresponding angles are equal and pairs of corresponding sides are in the same ratio.

b) No, the triangles are not congruent because corresponding sides are not equal.

3. a) $\angle M = \angle F$, $\angle N = \angle G$, $\angle P = \angle H$, $\angle Q = \angle J$

b) MN:FG = NP:GH = PQ:HJ = QM:JF

4. a) The quadrilaterals are not similar because there are no corresponding equal angles.

b) The pentagons are not similar because they have different shapes.

5. a) Check that student figures have corresponding angles equal and corresponding sides in the same ratio.

b) Check that student figures have corresponding angles equal and corresponding sides equal. Two congruent figures are similar because corresponding angles are equal and corresponding sides are in the same ratio (1:1).

6. a) $\angle C = 64°$, XY = 6 cm, AD = 9 cm, CD = 12 cm

b) $\angle D = 116°$, $\angle H = 128°$, DE = 10 m, EF = 20 m

REFLECT: Yes. In congruent figures, corresponding angles are equal and ratios of pairs of corresponding sides are always 1:1.

AFTER — Connect

It may help students to see the relationship between the rectangles if they are drawn in the same orientation.

Draw rectangle JKMN that is congruent to rectangle FGHE. Have students explain why rectangle JKMN is similar to rectangle ABCD.

Practice

Pattern Blocks are required for question 1, and square grid paper or dot paper is required for question 5.

Assessment Focus: Question 5

Students' figures may be simple, such as isosceles triangles or rectangles. Or, students' figures may be complex, such as irregular hexagons or octagons.

REACHING ALL LEARNERS

Common Misconception

➢ Students incorrectly think that two rectangles have the same shape because they are rectangular.

How to Help: Remind students that having the "same shape" means having corresponding angles equal and corresponding sides in the same ratio. Two rectangles always have corresponding angles equal. So, students must check the ratios of corresponding sides to find out if the rectangles are similar.

ASSESSMENT FOR LEARNING

What to Look For	What to Do
Knowledge and Understanding √ Students know that similar figures have corresponding angles equal and pairs of corresponding sides in the same ratio. ***Application*** √ Students can identify two similar figures. √ Students can differentiate between similar figures and congruent figures. ***Communication*** √ Students can explain why two figures are similar.	***Extra Support*:** Students can use Step-by-Step Master 7.33 to complete question 5. ***Extra Practice*:** Have students work in pairs. One student draws a figure on grid paper. The other student draws a congruent figure in a different orientation, then draws two similar figures — one larger than and one smaller than the original figure. Students exchange roles. ***Extension:*** Have students draw and label two similar figures with angle and side measures. Students then erase one angle measure and one side measure from their figures. Then they trade figures with a classmate and find the missing measures, without using a ruler or a protractor.

Recording and Reporting
Master 7.2 Ongoing Observations: Geometry

SECTION 7.2B

Technology: Dilatations

Curriculum expectations: Identify, perform, and describe dilatations, through investigation, using a variety of tools.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Identify, perform, and describe dilatations using a variety of tools.

Student Materials

- Masters 7.34, 7.35
- *The Geometer's Sketchpad*
- rulers
- grid paper
- geoboards
- square dot paper

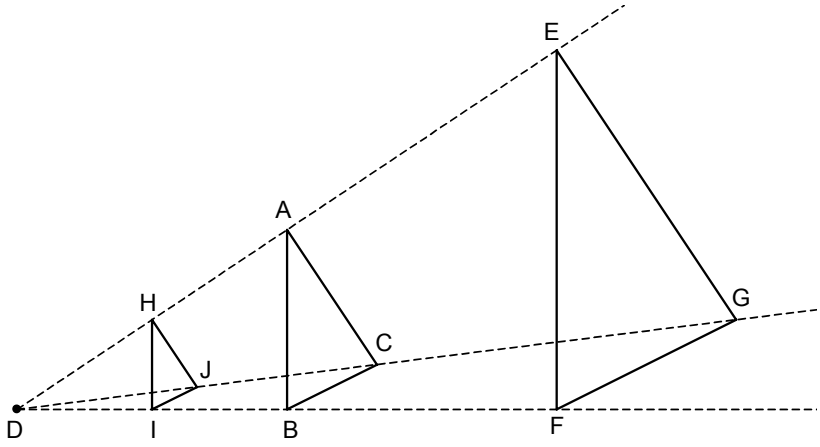
Key Math Learning

Computer software, such as *The Geometer's Sketchpad*, can be used to identify and perform dilatations.

BEFORE — Get Started

Tell students that another way to produce similar figures is by performing a transformation called a **dilatation**.

Show students how to use a ruler to draw dilatation images. On the board, draw ΔABC. Choose a dilatation centre D outside the triangle. Draw lines from that point through each vertex of the triangle. Mark respectively points H, I, and J at the midpoints of DA, DB, and DC. Join these points to form ΔHIJ. Mark point E so that AE = DA; mark point F so that BF = DB; and mark point G so that CG = DC. Join these three points to form ΔEFG.



Triangle EFG is an enlargement of ΔABC.
Triangle HIJ is a reduction of ΔABC.
Both ΔEFG and ΔHIJ are dilatation images of ΔABC.

Introduce *Explore*. Explain that computer software can be used to draw dilatation images, with the dilatation centre inside the figure.

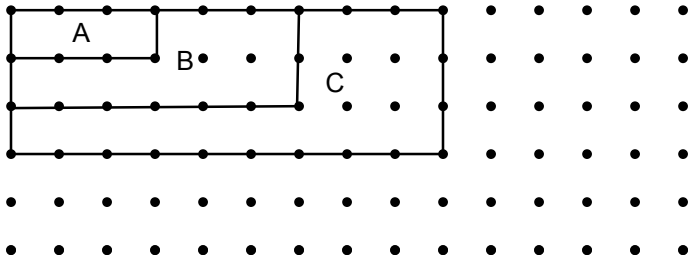
DURING — Explore

Watch to ensure that students understand and follow the directions carefully.

AFTER — Connect

Suggestions for Performing Dilatations without Software

Have students use geoboards to construct dilatation images. This time, the dilatation centre can be at a vertex of the original figure. Have students record their work on grid paper. Here is an example of an enlargement and a reduction of a rectangle. Rectangle B is the original figure, rectangle A is a dilatation image that is a reduction, and rectangle C is a dilatation image that is an enlargement.



Have students use grid paper to perform the dilatations. Students examine the properties that remain invariant.

REACHING ALL LEARNERS

Early Finishers
Have students draw enlargement and reduction dilatation images of a figure, then measure angles and sides to confirm that the figures are similar.

ASSESSMENT FOR LEARNING

What to Look For	What to Do
Knowledge and Understanding √ Students understand that a dilatation is a transformation that produces similar figures. ***Application*** √ Students can draw enlargements and reductions from dilatation centres at different positions.	***Extra Support*:** When students draw dilatation images, have them begin with simple figures, such as a rectangle, and draw them on grid paper. ***Extension:*** Have students draw a figure and one dilatation image, then trace the two figures. Students trade tracings with a classmate and find the dilatation centre.

Recording and Reporting
Master 7.2 Ongoing Observations: Geometry

SECTION 7.5A

7.5A Sorting Triangles and Quadrilaterals by Their Properties

Curriculum expectations: Sort and classify triangles and quadrilaterals by geometric properties related to symmetry, angles, and sides, through investigation using a variety of tools and strategies.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Sort and classify triangles and quadrilaterals by geometric properties using a variety of tools and strategies.

Student Materials
- Masters 7.36, 7.37, 7.38, 7.39

Optional
- Step-by-Step 5A (Master 7.40)

Assessment: Master 7.2 Ongoing Observations: Geometry

Key Math Learning
Figures can be sorted by geometric properties such as those related to symmetry, and measures of angles and sides.

BEFORE — Get Started

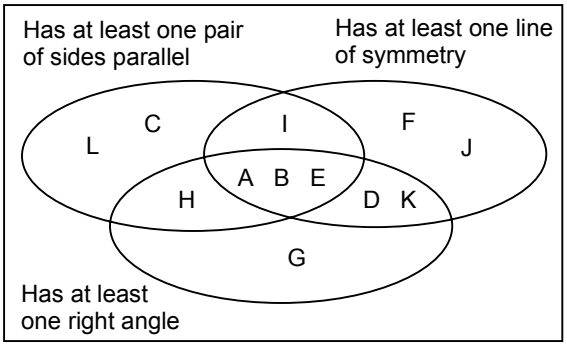
Review geometric properties of triangles and quadrilaterals. Review line and rotational symmetry, types of angles, parallel sides and perpendicular sides.

Present *Explore*. Remind students to choose properties that are common to some figures.

DURING — Explore

Ongoing Assessment: Observe and Listen

For students struggling with what properties to choose, suggest they consider parallel sides, lines of symmetry, and types of angles. One possible Venn diagram is shown.



Sample Answers

1.

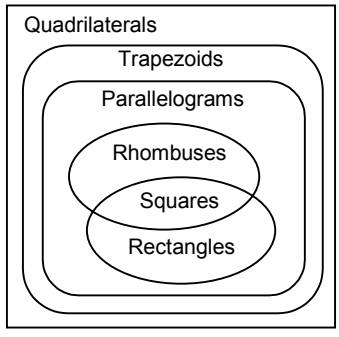
C, E, F	A, D
none	B, G

2.

T	none	none
X	U	Z
W	Y	V

3. a) 2 pairs of parallel sides; 4 right angles
b) 2 pairs of parallel sides; 2 pairs of equal sides
c) 4 sides; no right angles
d) A: exactly 2 lines of symmetry
B: 4 equal sides
C: exactly 1 line of symmetry
D: no equal sides
E: 2 pairs of parallel sides, with no right angles

4. Possible diagram:



Explanations may vary.
a) yes **b)** no
c) yes **d)** yes
e) no **f)** yes
g) yes **h)** no
i) yes **j)** no

REFLECT: No; all triangles that have 3 equal sides have 3 equal angles, each of which is 60°.

AFTER — Connect

Tell students that the table in the *Example* is a Carroll diagram. A Carroll diagram is used to sort objects by two properties. Have students explain why each figure is correctly placed in the table; for example, triangle B is an isosceles triangle with all acute angles so it has 1 line of symmetry but no right angles.

Practice

Assessment Focus: Question 4

Students should realize that parallelograms, rectangles, squares, and rhombuses are also trapezoids, because a trapezoid has a pair of parallel sides.

REACHING ALL LEARNERS

Early Finishers
Students chose two different properties by which to sort the figures in *Explore*. They make a Carroll diagram to sort the figures.

ASSESSMENT FOR LEARNING

What to Look For	What to Do
Knowledge and Understanding √ Students know that figures can be sorted or classified by their properties using different tools. ***Application*** √ Students can sort figures by their properties and display the results in a chart or diagram. ***Communication*** √ Students can create a chart or diagram to display the results of sorting figures by properties.	***Extra Support*:** Students can use Step-by-Step Master 7.40 to complete question 1. ***Extension:*** Extend *Explore*. After students have sorted their figures by the properties they chose, have student sketch a new figure for each region of their Venn diagram.

Recording and Reporting
Master 7.2 Ongoing Observations: Geometry

Master 7.26

7.1A Technology: Using a Computer to Construct Related Lines and Angle Bisectors

Software, such as *The Geometer's Sketchpad*, can be used to construct related lines and angle bisectors.

Constructing Parallel Lines

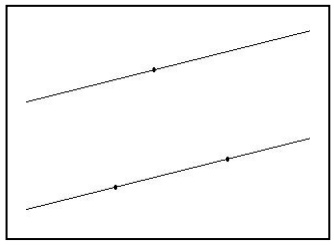
1. Open *The Geometer's Sketchpad*.
From the **File** menu, choose **New Sketch**.

2. From the **Toolbox**, choose . Click on the screen to construct a point.

3. From the **Toolbox**, click and hold .
You will see options for a line segment, ray, and line: .
Choose . Click and drag on the screen to draw a line that does not include the point you already placed.

4. From the **Toolbox**, choose . Select the point and line by clicking on them.

5. From the **Construct** menu, choose **Parallel Line**.
A line is drawn, through the point, parallel to the first line you drew.

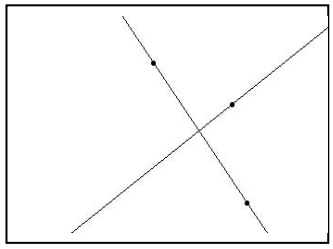


Constructing Perpendicular Lines

6. From the **File** menu, choose **New Sketch**.

7. Repeat *Steps 2* to *4*.

8. From the **Construct** menu, choose **Perpendicular Line**.
A line is drawn, through the point, perpendicular to the first line you drew.



Name:_____ Date:_____

Master 7.27

Section 7.1A Continued

Constructing Intersecting Lines at 30°, 45°, and 60°

9. From the **File** menu, choose **New Sketch**.

10. From the **Toolbox**, click and hold .
You will see options for a line segment, ray, and line: .
Choose . Click and drag on the screen to draw a line.
Draw another line that intersects the first line.

11. From the **Toolbox**, choose .
Select both lines by clicking on them.

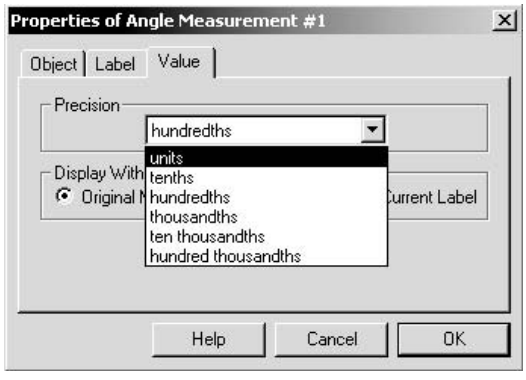
12. From the **Construct** menu, choose **Intersection**.
A new point appears where the lines intersect.

13. Click a blank area of the screen to deselect all objects.

14. From the **Toolbox**, choose A (Text Tool).
Click a point on the first line, the point of intersection, and a point on the second line to assign labels A, B, C.

15. From the **Toolbox**, choose .
Click a blank area of the screen to deselect all objects.
Click A, B, C in order. From the **Measure** menu, choose **Angle**.

16. Right click the angle measure.
Select **Properties…**.
Under the **Value** tab, select precision as **units**.
Then click **OK**.



17. Click point A.
Move the point until the measure of ∠ABC is 30°.

18. Repeat *Step 17* until the measure of ∠ABC is 45°.

19. Repeat *Step 17* until the measure of ∠ABC is 60°.

Master 7.28

Section 7.1A Continued

Constructing Angle Bisectors

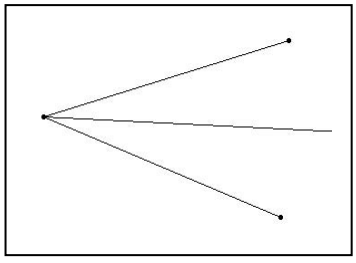
20. From the **File** menu, choose **New Sketch**.

21. From the **Toolbox**, click . Draw a segment.

22. Draw a second segment.
Make sure the segments have a common endpoint.

23. Click a blank area of the screen to deselect all objects.

24. From the **Toolbox**, choose . Select the three endpoints.
Make sure the common endpoint is the second point you select.
From the **Construct** menu, choose **Angle Bisector**.
The bisector of the angle you constructed is drawn.



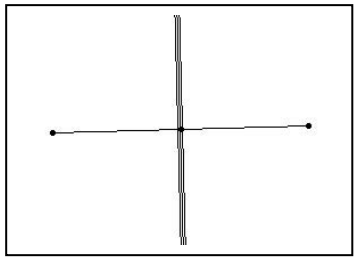
Constructing Perpendicular Bisectors

25. From the **File** menu, choose **New Sketch**.

26. From the **Toolbox**, click . Draw a segment.

27. From the **Construct** menu, choose **Midpoint**.

28. From the **Toolbox**, choose . Select the midpoint and segment.
From the **Construct** menu, choose **Perpendicular Line**.
The perpendicular bisector of the line you constructed is drawn.



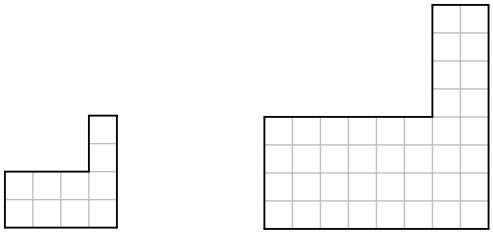
✓ Check

Open a new sketch. Draw lines that are parallel. Draw a line that intersects the parallel lines at 30°. Construct the angle bisector of the angle formed by one of the parallel lines and the line that intersects it.

Name:_____ Date:_____

Master 7.29

7.2A Similar and Congruent Figures



These figures have the same shape but different sizes.
Figures that have the same shape are similar.

Explore

Work with a partner.
You will need the 5 triangles from a tangram.

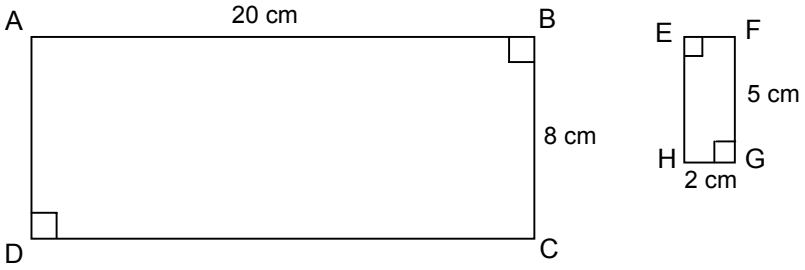
- Which triangles are similar? How do you know?
- Which triangles are congruent? How do you know?

Reflect & Share

Compare your results with those of another pair of students.
Are similar triangles congruent? Explain.
Are congruent triangles similar? Explain.

Connect

Consider these two rectangles.



Rectangles ABCD and FGHE have:
corresponding angles equal and ratios of pairs of corresponding sides equal

$\angle A = \angle F = 90°$	AB:FG = 20:5 = 4:1
$\angle B = \angle G = 90°$	BC:GH = 8:2 = 4:1
$\angle C = \angle H = 90°$	CD:HE = 20:5 = 4:1
$\angle D = \angle E = 90°$	AD:FE = 8:2 = 4:1

List the corresponding vertices of the rectangles in the same order.

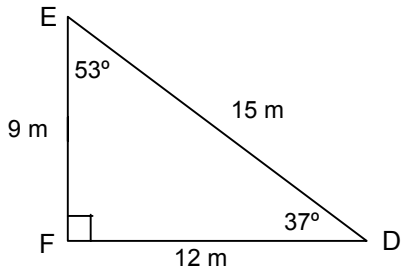
We say: Rectangle ABCD is similar to rectangle FGHE.

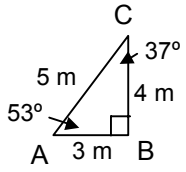
Section 7.2A Continued

Example

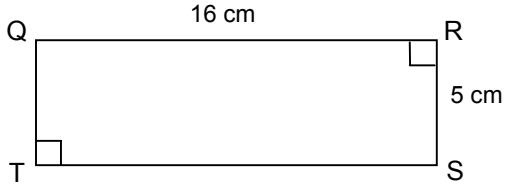
Are the figures in each pair similar? Explain.
Are the figures in each pair congruent? Explain.

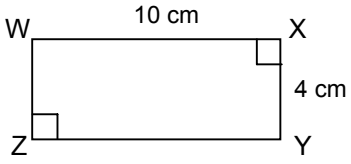
a)





b)





Solution

a) Look at the corresponding angles.
$\angle A = \angle E = 53°$
$\angle B = \angle F = 90°$
$\angle C = \angle D = 37°$

Look at the ratios of corresponding sides.
AC:ED = 5:15 = 1:3
AB:EF = 3:9 = 1:3
BC:FD = 4:12 = 1:3

Since corresponding angles are equal and ratios of corresponding sides are equal, ΔABC and ΔEFD are similar.
Since corresponding sides are not equal, the triangles are not congruent.

b) Look at the corresponding angles.
$\angle Q = \angle W = 90°$
$\angle R = \angle X = 90°$
$\angle S = \angle Y = 90°$
$\angle T = \angle Z = 90°$

Look at the ratios of corresponding sides.
Ratio of corresponding lengths = QR:WX = 16:10 = 8:5
Ratio of corresponding widths = RS:XY = 5:4
The ratios 8:5 and 5:4 are not equal.

So, rectangle QRST and rectangle WXYZ are not similar.
Since corresponding sides are not equal, the triangles are not congruent.

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Master 7.31

Section 7.2A Continued

Practice

1. Use Pattern Blocks.

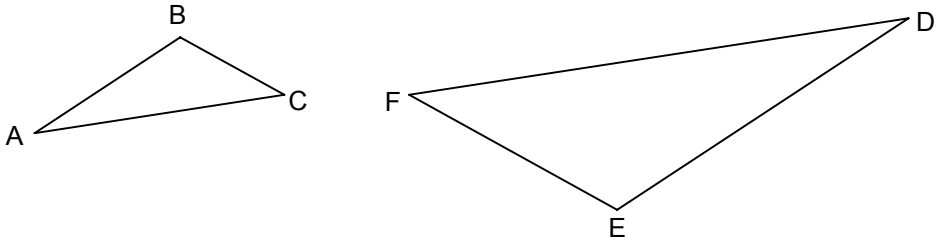
a) Can the blue rhombuses be combined to make a similar larger rhombus?
If your answer is yes, how do you know that the larger rhombus is similar to the blue rhombuses?
Sketch both rhombuses.

b) Repeat part a for each Pattern Block.

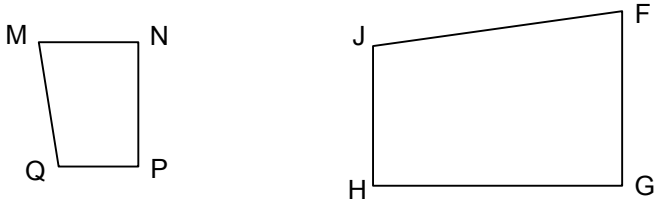
2. Measure the sides and angles of each triangle.

a) Are the triangles similar? Explain how you know.

b) Are the triangles congruent? Explain how you know.



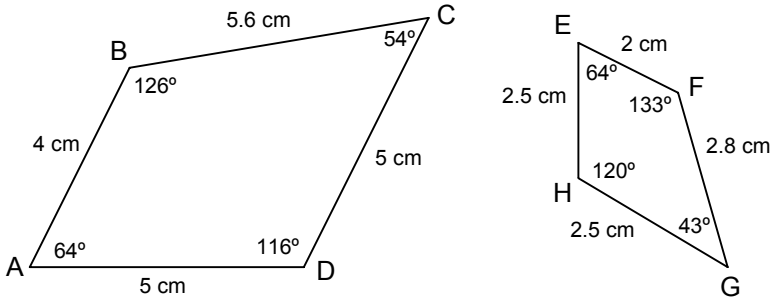
3. Quadrilateral MNPQ is similar to quadrilateral FGHJ.



a) Which angles are equal?

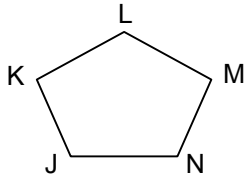
b) List pairs of corresponding sides that have equal ratios.

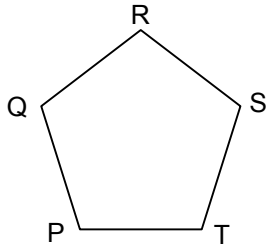
4. **a)** Are these quadrilaterals similar? How do you know?



Section 7.2A Continued

b) Are these pentagons similar? How do you know?





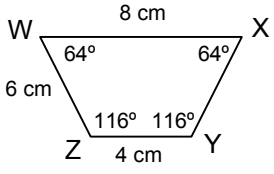
5. **Assessment Focus** Use square grid paper or dot paper.

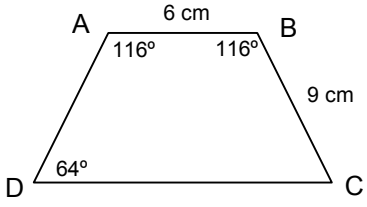
a) Draw two similar figures that are not congruent.
Explain how you know the figures are similar.

b) Draw two congruent figures.
Are the figures similar?
How do you know?

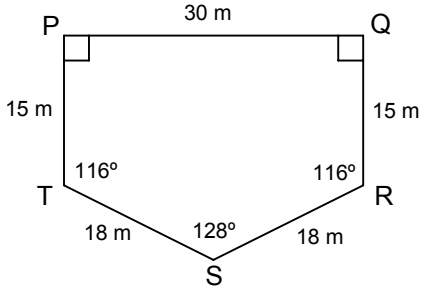
6. The two figures in each pair are similar.
Find the measures of the missing angles and side lengths.

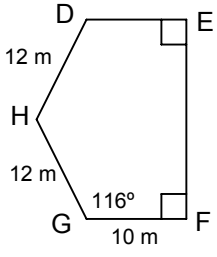
a)





b)





Reflect

Are congruent figures similar figures? Explain.

.

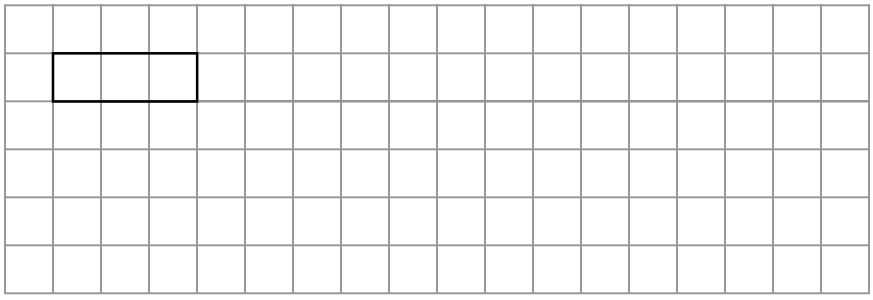
Name:_____ Date:_____

Master 7.33

Step-by-Step 2A

Section 7.2A, Question 5

Step 1 Draw a rectangle that is similar to the rectangle below.

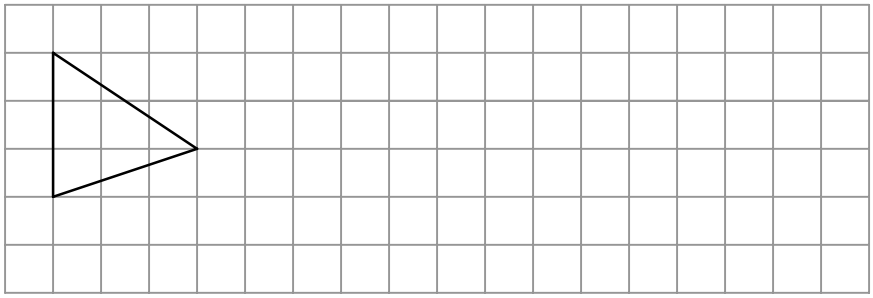


Step 2 How do you know the rectangles are similar?

_____

_____

Step 3 Draw a triangle that is congruent to the triangle below.



Step 4 Are the triangles similar? _____

How do you know? _____

_____

Master 7.34

7.2B Technology: Dilatations

Software, such as *The Geometer's Sketchpad*, can be used to perform dilatations.

Follow these steps:

1. Open *The Geometer's Sketchpad*.
From the **File** menu, choose **New Sketch**.

To make a "grid paper" screen:

2. From the **Edit** menu, choose **Preferences**.
Select the **Units** tab.
Check that **Distance** is cm.
Click **OK**.

3. From the **Graph** menu, choose **Define Coordinate System**.
The screen has grid lines and two numbered axes.

4. From the **Toolbox**, choose  .
Click each axis and the point (1, 0) to highlight them.
From the **Display** menu, choose **Hide Objects**.
The screen looks like a piece of grid paper, with a point at the origin.

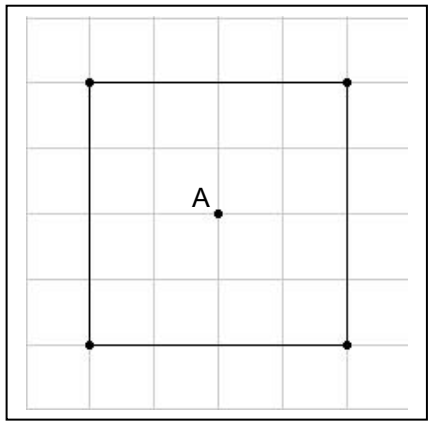
5. From the **Toolbox**, choose  (Text Tool).
Click the point where the origin was to label it A.

6. From the **Graph** menu, choose **Snap Points**.

Enlargement

7. From the **Toolbox**, choose  . Click and drag to construct a square with side length 4 units, with the centre of the square at A.

8. To enlarge the square:
From the **Toolbox**, choose  .
Click the four sides of the square to highlight them.



Name:_____ Date:_____

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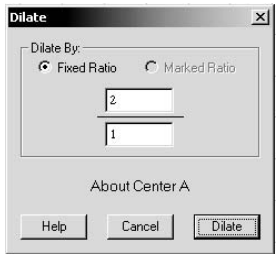
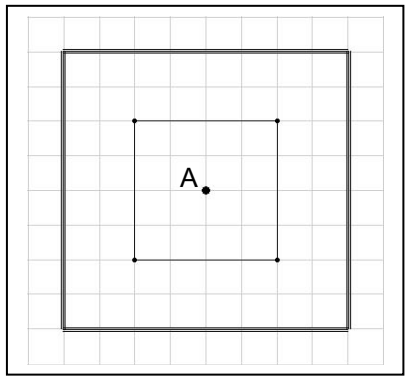
Section 7.2B Continued

9. From the **Transform** menu, choose **Dilate**.
In the top box, type 2.
In the bottom box, type 1. Click **Dilate**.
The ratio of the side lengths of the new square to the original square is 2:1.
That is, the side length is multiplied by 2.

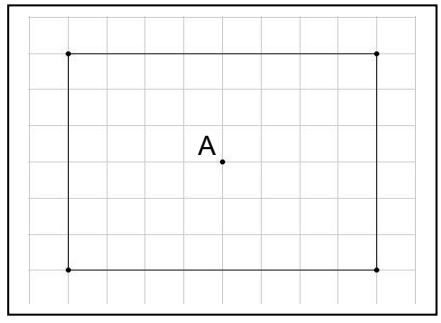




Reduction

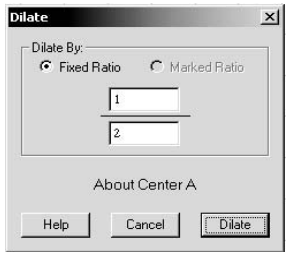
10. Repeat *Steps 1* to *6*.

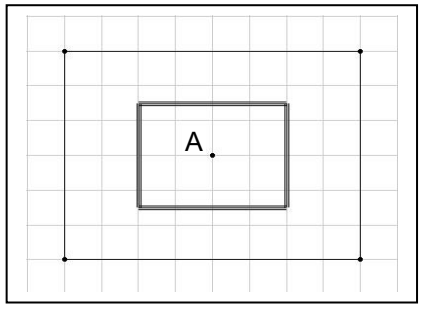
11. From the **Toolbox**, choose  .
Click and drag to construct a rectangle, 8 units by 6 units, with the centre of the rectangle at A.



12. To reduce the rectangle:
From the **Toolbox**, choose  .
Click the four sides of the rectangle to highlight them.

13. From the **Transform** menu, choose **Dilate**.
In the top box, type 1.
In the bottom box, type 2. Click **Dilate**.
The ratio of the side lengths of the new rectangle to the original rectangle is 1:2.
That is, each side length is divided by 2.





✓ Check

Open a new sketch. Draw a rectangle with the centre of the rectangle at A.
Reduce the rectangle. Then enlarge the rectangle.

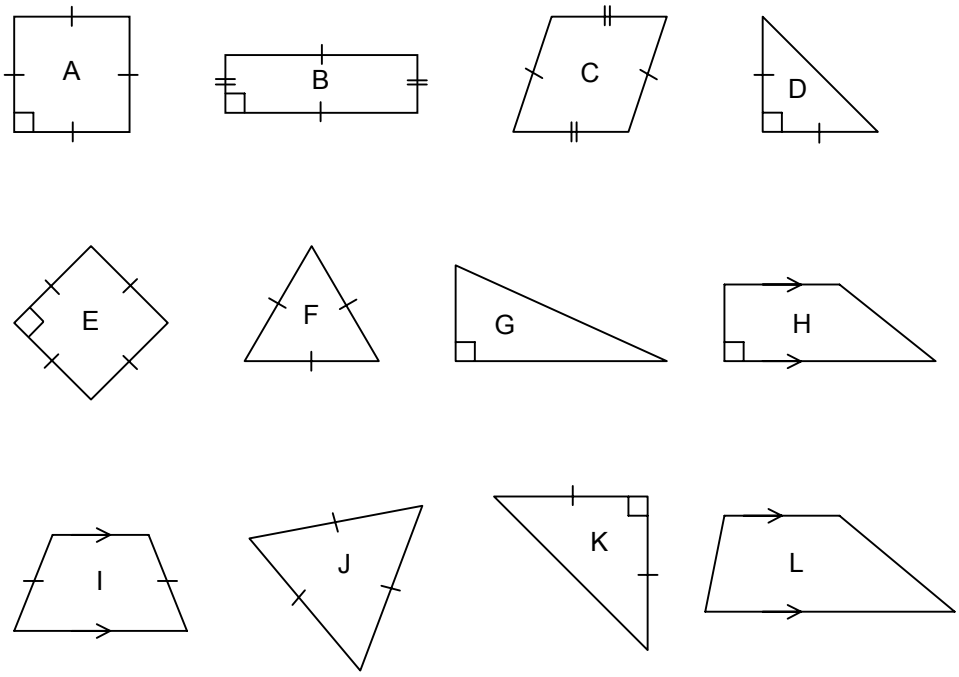
Master 7.36

7.5A Sorting Triangles and Quadrilaterals by Their Properties

Explore

Work with a partner.

- Choose three properties.
- Use a Venn diagram to sort the triangles and quadrilaterals according to the three properties.



Reflect & Share

Compare your Venn diagram with that of another pair of students.
Trade Venn diagrams.
Check that the Venn diagram includes all figures.

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Section 7.5A Continued

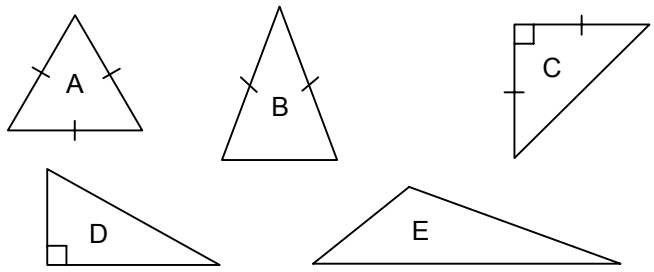
Connect

You can sort figures by

- the properties of their sides
  - equal sides
  - parallel sides
- the properties of their angles
  - equal angles
  - acute, obtuse, or right angles
- symmetry
  - line symmetry
  - rotational symmetry
- congruency and similarity

Example

Use the properties in the table below to sort these figures.



Property	Has at least 1 right angle	Has no right angles
Has at least 1 line of symmetry		
Has no lines of symmetry		

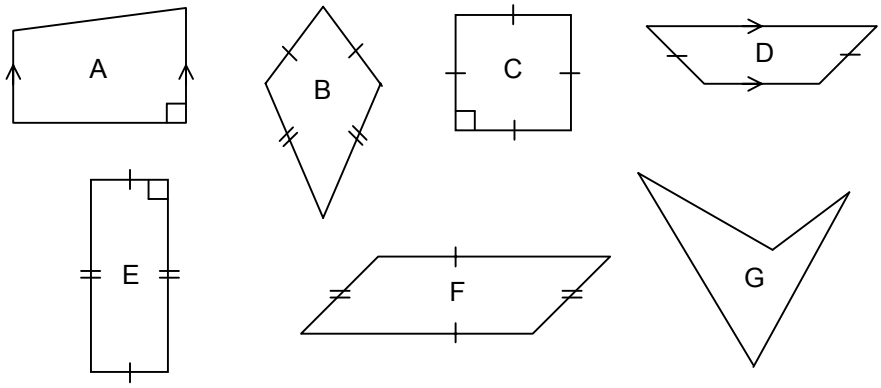
Solution

Property	Has at least 1 right angle	Has no right angles
Has at least 1 line of symmetry	C	A, B
Has no lines of symmetry	D	E

Section 7.5A Continued

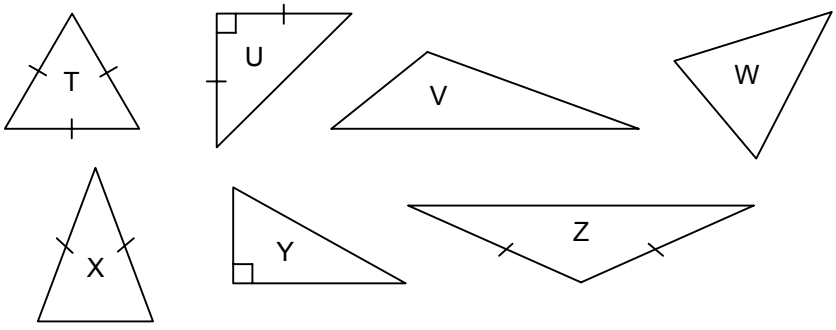
Practice

1. Use the properties in the table below to sort these figures.



Property	Has rotational symmetry	Has no rotational symmetry
Has at least 1 pair of parallel sides		
Has no pairs of parallel sides		

2. Use the table. Sort these triangles by angles and sides.

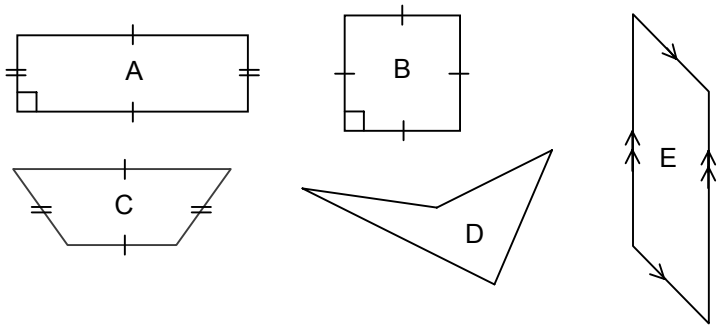


Property	Has 3 acute angles	Has 1 right angle	Has 1 obtuse angle
Has 3 equal sides			
Has exactly 2 equal sides			
Has no equal sides			

Section 7.5A Continued

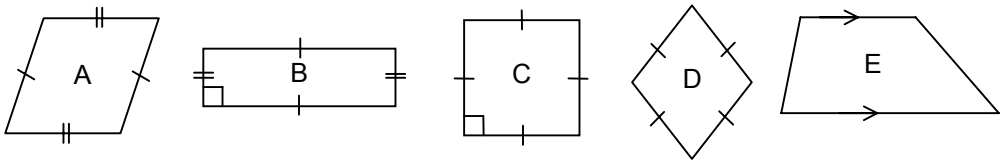
Name:_____ Date:_____

3. Examine the quadrilaterals below.



a) Name two properties that are common to Figure A and Figure B.
b) Name two properties that are common to Figure A and Figure D.
c) Name two properties that are common to Figure C and Figure E.
d) Name a property that is unique to each figure.

4. **Assessment Focus** Answer the questions below.
Use your answers to sort the figures in a Venn diagram.



a) Are all squares rectangles? Explain.
b) Are all rectangles squares? Explain.
c) Are all rhombuses parallelograms? Explain.
d) Are all rectangles parallelograms? Explain.
e) Are all trapezoids parallelograms? Explain.
f) Are all trapezoids quadrilaterals? Explain.
g) Are all squares rhombuses? Explain.
h) Are all rhombuses squares? Explain.
i) Are all squares trapezoids? Explain.
j) Are all rectangles rhombuses? Explain.

Reflect

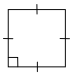
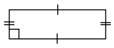
Can a triangle have 1 right angle and 3 equal sides? Explain.

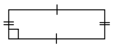
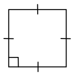
Name:____________________ Date:________________

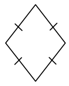
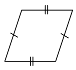
Master 7.40

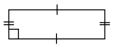
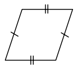
Step-by-Step 5A

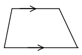
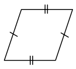
Section 7.5A, Question 4

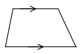
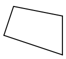
Step 1 Is a  a  ? ________________

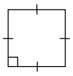
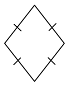
Is a  a  ? ________________

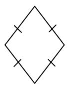
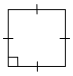
Is a  a  ? ________________

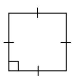
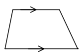
Is a  a  ? ________________

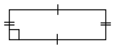
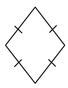
Is a  a  ? ________________

Is a  a  ? ________________

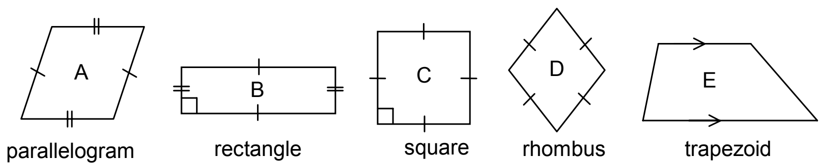
Is a  a  ? ________________

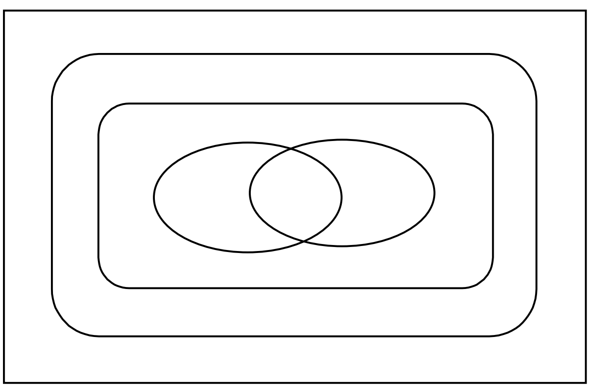
Is a  a  ? ________________

Is a  a  ? ________________

Is a  a  ? ________________

Step 2 Sort these figures in the Venn diagram below. Label each loop.





Unit 8 Working with Percents

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Optional but recommended	
8.1: Relating Fractions, Decimals, and Percents	Required	
8.2: Estimating and Calculating Percents	Required	
8.3: Multiplying to Find Percents	Required	
8.4: Drawing Circle Graphs	Required	
8.5: Dividing to Find Percents	Required	
Unit Problem: At the Shopping Mall	Required	

Skills You'll Need: Although this material is not directly required by your curriculum, the material is recommended as a prerequisite for the sections in this Unit.

Unit 9 Integers

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Optional but recommended	
9.1: What Is an Integer	Required	
9.2: Comparing and Ordering Integers	Required	
9.3: Representing Integers	Required	
9.4: Adding Integers with Tiles	Required	
9.5: Adding Integers	Required	
9.6: Subtracting Integers with Tiles	Required	
9.7: Subtracting Integers	Required	
9.7A: Plotting Points on a Coordinate Grid **Curriculum expectation**: Plot points using all four coordinates of the Cartesian coordinate plane.	Required	Masters 9.26 to 9.29 Step-by-Step 7A: Master 9.30 grid paper
Unit Problem: What Time Is It?	Required	

Skills You'll Need: Although this material is not directly required by your curriculum, the material is recommended as a prerequisite for the sections in this Unit.

SECTION 9.7A

Plotting Points on a Coordinate Grid

Curriculum expectation: Plot points using all four quadrants of the Cartesian coordinate plane.

SECTION ORGANIZER 40–50 min

Curriculum Focus: Plot points using all four quadrants of a coordinate grid.

Student Materials
- Masters 9.26, 9.27, 9.28, 9.29
- grid paper

Optional
- Step-by-Step 7A (Master 9.30)

Assessment: Master 9.2 Ongoing Observations: Integers

Key Math Learnings

1. The *x*- and *y*- axes divide a coordinate grid into four quadrants.
2. An ordered pair tells the position of a point on a coordinate grid.

BEFORE Get Started

Review how to plot points in the first quadrant of a coordinate grid. Have students identify the coordinates of the plotted points, and explain how to plot a point, given its coordinates.

Present *Explore*.

DURING Explore

Ongoing Assessment: Observe and Listen

Ask questions such as:

- How did you write the coordinates of this point? (*I counted how many units I moved right from the origin, and how many units I moved down. When I move right, the distance is a positive integer. When I move down, the distance is a negative integer.*)
- How did you plot this point? (*The first coordinate is –3. So, I started at –3 on the x-axis. The second coordinate is –6. So, I then moved 6 units down, and mark the point.*)

Sample Answers

1. Quadrant 1: C(4, 4)
Quadrant 2: A(–6, 2), B(–4, 7)
Quadrant 3: F(–2, –5), G(–5, –6)
Quadrant 4: D(5, –1), E(3, –7)

2. Answers will vary.
Check students' grids.

3. Check students' grids.

4. a) Start at 7 on the *x*-axis.
Move 8 units up.
b) Start at 4 on the *x*-axis.
Move 2 units down.
c) Start at –3 on the *x*-axis.
Move 6 units up.
d) Start –5 on the *x*-axis.
Move 9 units down.

5. a) Check students' grids.
b) Quadrant 1: F, W
Quadrant 2: H, Q
Quadrant 3: K, R
Quadrant 4: J, S
c) x-axis: I, L
y-axis: G, M

6. a) Check students' grids.
b) rectangle
c) Perimeter: 44 units
Area: 120 square units

7.

x-coordinates	*y*-coordinates
+	+
–	+
–	–
+	–
+/–	0
0	+/–

a) negative *x*-coordinates
b) positive *y*-coordinates
c) negative *y*-coordinates

REFLECT: A point that has *x*-coordinate 0 is on the *y*-axis. A point that has *y*-coordinate 0 is on the *x*-axis.

AFTER — Connect

Have student volunteers show their plotted points on an overhead projector. Relate positive coordinates to positive integers that represent distances to the right or up. Relate negative coordinates to negative integers that represent distances to the left or down.

Practice

Have 0.5-cm grid paper available for questions 2, 3, 5, and 6.

Assessment Focus: Question 6

Students should see the length and the width of the rectangle, measured in units, can be used to find its perimeter and area. Student may make connections between the coordinates of the points and the measures of line segments formed by joining these points.

REACHING ALL LEARNERS

Common Misconception

- Students transpose the coordinates when they point a point.

How to Help: Have students think of a way to remember that the first coordinate represents a movement right or left (FRL) and the second coordinate represents a movement up or down (SUD); perhaps "Fried Rice Last" and "Saucer Under Dish."

ASSESSMENT FOR LEARNING

What to Look For	What to Do
Knowledge and Understanding √ Students understand how to plot points using all four quadrants of the coordinate plane. ***Application*** √ Students can plot a point on a coordinate grid, given its coordinates. √ Students can identify the coordinates of a point.	***Extra Support*:** Students can use Step-by-Step Master 9.30 to complete question 6. ***Extra Practice*:** Have students draw a design on a coordinate grid. Then they use coordinates to write instructions for the re-creation of the design. Students trade instructions with a classmate and re-create their classmate's design. ***Extension:*** Have students make a coordinate map of their classroom. Have them mark key locations on the map and provide the coordinates of each location.

Recording and Reporting
Master 9.2 Ongoing Observations: Integers

Name:_____ Date:_____

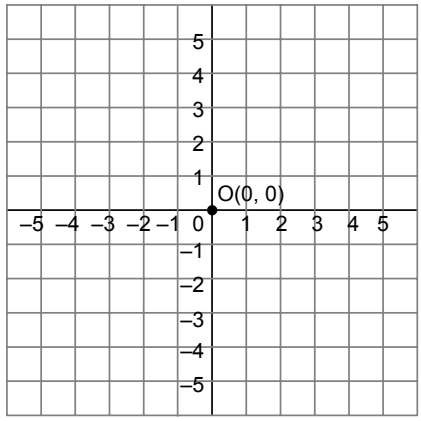
Master 9.26

9.7A Plotting Points on a Coordinate Grid

Explore

Work with a partner.
You will need grid paper and a ruler.

- Copy the two number lines on grid paper.
  The number lines intersect at point O.
- Mark 2 points in each of the 4 parts of the grid.
  Mark 1 point on each of the 4 parts of the number lines.
  Label the 12 points from A to L.
  Write the coordinates of each point.
- Trade coordinates with your partner.
  On a second copy of the grid, plot your partner's points.

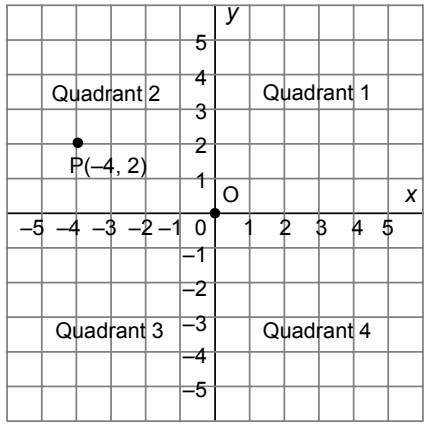


Reflect & Share

Compare your plotted points and their coordinates with those of your partner.
If the points and coordinates do not match, find out why.

Connect

A **coordinate grid** is formed by two perpendicular number lines.
The horizontal number line is the ***x*-axis**.
The vertical number line is the ***y*-axis**.
These axes intersect at the **origin**, O.
The *x*- and *y*-axes divide the coordinate grid into four **quadrants**.
The quadrants are numbered counterclockwise.



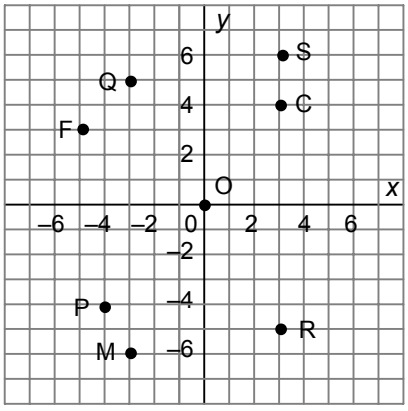
The coordinates are an **ordered pair** of numbers.
In Quadrant 2, P has coordinates (–4, 2).
The first number, –4, is the ***x*-coordinate**.
It tells how far to the right or left of the *y*-axis a point is located.
The second number, 2, is the ***y*-coordinate**.
It tells how far up or down from the *x*-axis a point is located.

Section 9.7A Continued

Example 1

Which point on the grid has each pair of coordinates?

a) (3, 4) **b)** (–5, 3) **c)** (–3, –6) **d)** (3, –5)



Solution

Start at the origin each time.

a) Move 3 units right and 4 units up. Point C has coordinates (3, 4).

b) Move 5 units left and 3 units up. Point F has coordinates (–5, 3).

c) Move 3 units left and 6 units down. Point M has coordinates (–3, –6).

d) Move 3 units right and 5 units down. Point R has coordinates (3, –5).

Example 2

Plot and label each point on a coordinate grid.

a) W(1, 6) **b)** V(–2, –4) **c)** U(0, –7) **d)** T(–6, 0)

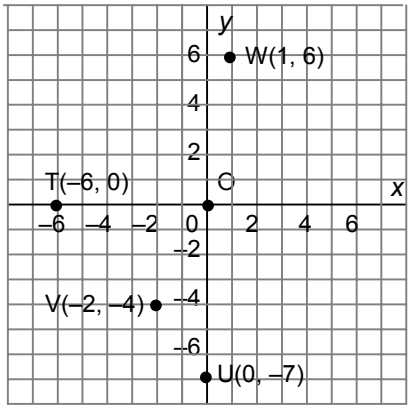
Solution

a) Start at 1 on the *x*-axis.
Move 6 units up.
Mark and label the point W(1, 6).

b) Start at –2 on the *x*-axis.
Move 4 units down.
Mark and label the point V(–2, –4).

c) Start at the origin.
Move 7 units down the *y*-axis.
Mark and label the point U(0, –7).

d) Start at –6 on the *x*-axis.
Since there is no movement up or down,
mark and label the point T(–6, 0).



Start by locating the first number of the ordered pair on the *x*-axis.

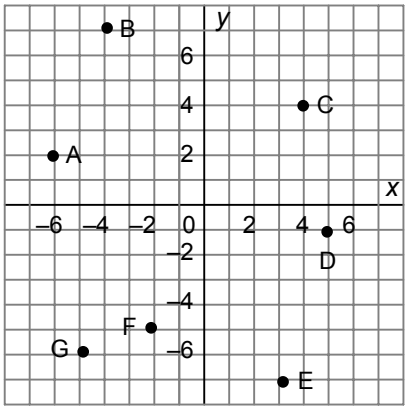
Name:_____ Date:_____

Master 9.28

Section 9.7A Continued

Practice

1. Name the quadrant in which each point is located, then write its coordinates.



2. Draw a coordinate grid on grid paper.

a) Draw an octagon that has one vertex in each quadrant, and one vertex on each part of the axes.

b) Label each vertex with its coordinates.

c) Trade coordinates with a classmate and draw her octagon.

3. The coordinate grid represents a map of a town.
Mark and label each point on the map.

a) The high school is at O(0, 0).

b) The junior high school is at J(7, –2).

c) The elementary school is at E(–4, –3).

d) The fitness club is at F(5, 4).

e) The gymnasium is at G(–4, 5).

f) The art gallery is at A(–6, –7).

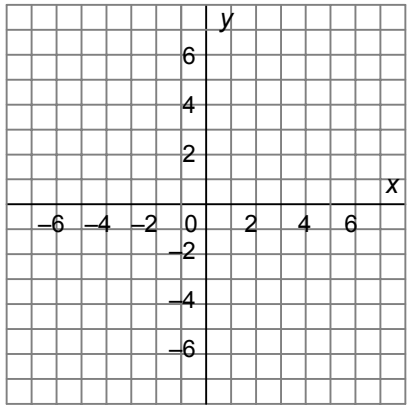
g) The bus stop is at B(2, –3).

h) The post office is at P(7, 0).

i) The grocery store is at S(–5, 0).

j) The library is at L(0, 5).

k) The gas station is at C(0, –3).



4. Describe how you plot each point on a coordinate grid.

a) M(7, 8) **b)** N(4, –2) **c)** P(–3, 6) **d)** Q(–5, –9)

Section 9.7A Continued

5. Draw a coordinate grid on grid paper.

a) Plot these points on the grid.
F(6, 8), G(0, 4), H(–4, 9), I(2, 0), J(3, –5), K(–1, –8), L(–7, 0), M(0, –5), W(5, 3), Q(–1, 2), R(–7, –3), and S(1, –6).

b) Which points are in Quadrant 1? Quadrant 2? Quadrant 3? Quadrant 4?

c) Which points are on the *x*-axis? The *y*-axis?

6. **Assessment Focus** Use a coordinate grid.

a) Plot the points Q(–7, 4), R(5, 4), S(5, –6), and T(–7, –6).

b) Join QR, RS, ST, and TQ. Which geometric figure did you draw?

c) Find the perimeter and area of the figure.

7. Complete the table.
Write "+" if the coordinates are always positive.
Write "–" if the coordinates are always negative.
Write "0" if the coordinates are neither positive nor negative.
Write "+/–" if the coordinates can be positive or negative.

	***x*-coordinates**	***y*-coordinates**
Quadrant 1		
Quadrant 2		
Quadrant 3		
Quadrant 4		
***x*-axis**		
***y*-axis**		

a) What do points in Quadrants 2 and 3 have in common?

b) What do points in Quadrants 1 and 2 have in common?

c) What do points in Quadrants 3 and 4 have in common?

Reflect

On a coordinate grid, where is a point that has *x*-coordinate 0?
On a coordinate grid, where is a point that has *y*-coordinate 0?

Name:_____ Date:_____

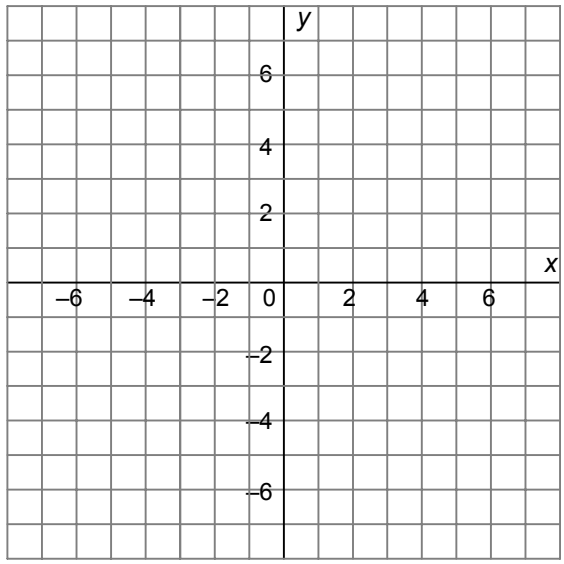
Master 9.30

Step-by-Step 7A

Section 9.7A, Question 6

Step 1 Plot each point in the coordinate grid below.

Q(–7, 4)
R(5, 4)
S(5, –6)
T(–7, –6)



Step 2 Join QR, RS, ST, and QT.

Which figure did you draw? _____

Step 3 Find each length in units.

QR = _____

RS = _____

ST = _____

QT = _____

Step 4 What is the perimeter of the figure? _____

What is the area of the figure? _____

Unit 10 Patterning and Algebra

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Required	
10.1: Number Patterns	Required: see Focus Note 10.1	
10.2: Graphing Patterns	Required	
10.3: Variables in Expressions	Required	
10.4: Evaluating Algebraic Expressions	Required: see Focus Note 10.4	
10.5: Reading and Writing Equations	Required	
10.6: Solving Equations	Required	
Unit Problem: Fund Raising	Required	

10.1: Number Patterns

Focus Note 10.1

Curriculum expectation: Develop and represent the general term of a linear growing pattern, using algebraic expressions involving one operation.

Curriculum Focus

Your curriculum requires that students can represent the general term of a linear growing pattern, using algebraic expressions involving one operation.

Extend *Connect*. Introduce a pattern of consecutive numbers starting with 1: 1, 2, 3, 4, 5, … Have students identify the 10th term as 10, the 100th term as 100, then introduce n to represent the term number, and the general term.

Continue with the pattern 2, 3, 4, 5, 6, … The 1st term is 1 + 1, the 2nd term is 2 + 1, the 3rd term is 3 + 1, … So, the 10th term is 10 + 1, the 100th term is 100 + 1, and the general term is n + 1.

Then introduce a pattern of multiples such as: 2, 4, 6, 8, 10, … The 1st term is 2 × 1, the 2nd term is 2 × 2, the 3rd term is 2 × 3, … So, the 10th term is 2 × 10, the 100th term is 2 × 100, and the general term is 2 × n, or 2n.

Continue with other examples of sets of consecutive numbers or multiples.

10.4: Evaluating Algebraic Expressions

Focus Note 10.4

Curriculum expectation: Make connections between evaluating algebraic expressions and determining the term in a pattern using the general term.

Curriculum Focus

The curriculum requires that students can make connections between evaluating algebraic expressions and determining the terms in a pattern using the general term.

Extend the *Example* on pages 383 and 384 of the student book.

Explain that $2k + 2$ is the general term of a number pattern. Substitute $k = 1, 2, 3, 4, 5, \ldots$ to generate the pattern: 7, 12, 17, 22, 27, …

Then continue with the pattern that follows the *Example*.

The expression $3n + 2$ is the general term of the number pattern: 5, 8, 11, 14, 17, … In the Input/Output table on page 384 of the student book, the input numbers are the term numbers and the output numbers are the term values.

As students complete *Practice* question 1 parts a, b, and e, question 2 part a, and question 3 parts b and d, have students use each expression as a general term of a number pattern, and substitute 1, 2, 3, 4, 5, and so on, to generate the patterns.

Unit 11 Probability

Section	Curriculum Coverage	Section Masters and Materials
Skills You'll Need	Optional but recommended	
11.1: Listing Outcomes	Required	
11.2: Experimental Probability	Required	
11.3: Theoretical Probability	Required	
11.4: Applications of Probability	Required: see Focus Note 11.4	number cubes labelled 1 to 6, coins
Unit Problem: Games of Chance	Required	
Cross Strand Investigation: A Population Simulation	Required	

Skills You'll Need: Although this material is not directly required by your curriculum, the material is recommended as a prerequisite for the sections in this Unit.

Focus Note 11.4

Curriculum expectations: Make predictions about a population when given a probability. Perform a simple probability experiment involving two independent events, and compare the experimental probability with the theoretical probability of a specific outcome.

Student materials: number cubes labelled 1 to 6, coins

Curriculum Focus

The curriculum requires that students can make predictions about a population when given a probability.

Extend *Practice*. Have students answer these questions:

7. The probability of picking a red marble from a bag of marbles is $\frac{2}{3}$. There are 18 red marbles in the bag. Predict the total number of marbles in the bag. (*Answer: 27*)

8. The probability that a randomly chosen resident of Ontario lives in Toronto is 20%. In 2001, the population of Ontario was about 11 410 000. About how many people lived in Toronto in 2001? (*Answer: about 2 382 000*)

9. The probability that a randomly chosen student in a school is a band member is 12%. There are 405 students in the school. About how many band members does the school have? (*Answer: about 49*)

10. In 2001, the probability that a resident of Canada over the age of 15 had a Bachelor's degree from a university was 10%. There were about 24 000 000 residents over the age of 15 in Canada in 2001. About how many of the residents over the age of 15 would you expect to have a Bachelor's degree? (*Answer: about 2 400 000*)

The curriculum also requires that students perform a simple probability experiment involving two independent events, and compare the experimental probability with the theoretical probability of a specific outcome.

Have students conduct an experiment of rolling a number cube labelled 1 to 6 and tossing a coin, 120 times. Students record the number of times each of these outcomes occurs:

(1, Heads), (2, Heads), (3, Heads), (4 Heads), (5, Heads), (6, Heads), (1, Tails), (2, Tails), (3, Tails), (4 Tails), (5, Tails), and (6, Tails)

The theoretical probability of each outcome is $\frac{1}{10}$. Students compare the experimental probability with the theoretical probability of each outcome and explain why they are, or may be, different.

Correlation of Ontario Mathematics 2005 Curriculum to Addison Wesley Math Makes Sense 7

Mathematical Process Expectations

The mathematical process expectations are to be integrated into student learning associated with all the strands.

Throughout Grade 7, students will:

Mathematical Process Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, Correlation:**
Problem Solving develop, select, apply, and compare a variety of problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;	*Throughout the program.* ***Math Makes Sense*** follows a problem-solving approach in every lesson, with **Explore** activities that lead students to conceptual understanding at a developmentally appropriate level; **Reflect & Share** discussions allow students to deepen their mathematical understanding of that central problem through sharing perspectives on the same problem or investigation. **Practice** questions include a range of problem types, regularly including a non-routine problem in the **Assessment Focus** question. Further explicit support in developing problem-solving strategies is featured in **Connect** sections, where mathematical thinking is modeled, and in **Reading and Writing in Math** lessons. Students apply their problem-solving strategies throughout each lesson, and in **Unit Problems** and **Cross-Strand Investigations**.

Throughout Grade 7, students will:

Mathematical Process Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, Correlation:**
Reasoning and Proving develop and apply reasoning skills (e.g., recognition of relationships, generalization through inductive reasoning, use of counter-examples) to make mathematical conjectures, assess conjectures and justify conclusions, and plan and construct organized mathematical arguments;	*Throughout the program*. Because ***Math Makes Sense*** is grounded in a problem-solving approach to developing mathematical ideas, the program consistently calls on students to apply their reasoning skills in the central **Explore** activities, during follow-up **Reflect & Share** discussions, and in completing a range of **Practice** questions. Discussion prompts and Practice questions regularly ask students to explain their reasoning. **Connect** summaries help to model the reasoning behind mathematical concepts, as they offer consolidation of concepts. **Unit Problems** and **Cross-Strand Investigations** also draw on students' reasoning skills as they work through a more comprehensive problem.

Throughout Grade 7, students will:

Mathematical Process Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, Correlation:**
Reflecting demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem (e.g., by assessing the effectiveness of strategies and processes used, by proposing alternative approaches, by judging the reasonableness of results, by verifying solutions);	*Throughout the program*. ***Math Makes Sense*** offers regular opportunities to encourage students to reflect on their strategies and monitor their progress with a problem or investigation, through such features as **Reflect & Share** discussions in each **Explore**, selected **Practice** questions including **Assessment Focus** questions that direct students to explain their thinking, and **Reflect** prompts at the close of each lesson. **Connect** sections in each lesson model the process of reflection during problem solving.

Through Grade 7, students will:

Mathematical Process Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, Correlation:**
Selecting Tools and Computational Strategies select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;	*Throughout the program*. **Explore** activities either explicitly identify materials to use, to provide students with experience using a range of materials, or they allow students to select the most appropriate tool. Similarly, **Practice** questions may leave the choice of tool to students as they prepare to solve a problem. Students have opportunities to select appropriate computational strategies in the regularly occurring features entitled **Number Strategies**, **Mental Math**, or **Calculator Skills. Technology** features and **Technology** lessons develop ongoing expertise in use of electronic learning tools.

Through Grade 7, students will:

Mathematical Process Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, Correlation:**
Connecting make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts (e.g., other curriculum areas, daily life, current events, art and culture, sports);	*Throughout the program*. In addition to the ongoing developmental flow, in which applications-based problems surface regularly in **Explore**, **Connect**, and **Practice** questions, the Student Book highlights connections in **Unit Problems**, **Cross-Strand Investigations**, **Math Links**, and feature pages on **The World of Work**.

Through Grade 7, students will:

Mathematical Process Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, Correlation:**
Representing create a variety of representations of mathematical ideas (e.g., numeric, geometric, algebraic, graphical, pictorial; onscreen dynamic representations), connect and compare them, and select and apply the appropriate representations to solve problems;	*Throughout the program*. **Explore** activities help develop students' facility with multiple representations through the range of materials and representations to which students are exposed across the course of the program; **Reflect & Share** discussions encourage students to think about multiple representations of the same concept, while **Connect** summaries model such representations.

Through Grade 7, students will:

Mathematical Process Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, Correlation:**
Communicating communicate mathematical thinking orally, visually, and in writing, using mathematical vocabulary and a variety of appropriate representations, and observing mathematical conventions.	*Throughout the program*. In addition to the ongoing developmental flow, supporting Student Book features include: **Reflect & Share** discussions in each **Explore** activitiy; **Connect** summaries to model consolidation of concepts and mathematical conventions; **Assessment Focus** questions; **Reflect** prompts at the close of each lesson; **Reading and Writing in Math** lessons; **Unit Problems**; **Cross-Strand Investigations; Key Words** at the start of each unit, and an illustrated **Glossary**.

Number Sense and Numeration

Overall Expectations

By the end of Grade 7, students will:

- represent, compare, and order numbers, including integers;
- demonstrate an understanding of addition and subtraction of fractions and integers, and apply a variety of computational strategies to solve problems involving whole numbers and decimal numbers;
- demonstrate an understanding of proportional relationships using percent, ratio, and rate.

Students will:

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
Quantity Relationships represent, compare, and order decimals to hundredths and fractions, using a variety of tools (e.g., number lines, Cuisenaire rods, base ten materials, calculators);	Unit 4 Skills You'll Need, 8.1
generate multiples and factors, using a variety of tools and strategies (e.g., identify multiples on a hundreds chart; create rectangles on a geoboard);	1.2
identify and compare integers found in real-life contexts (e.g., -10ºC is much colder than +5ºC);	9.1
represent and order integers using a variety of tools (e.g., two-colour counters, virtual manipulatives, number lines);	9.2, 9.3
select and justify the most appropriate representation of a quantity (i.e., fraction, decimal, percent) for a given context (e.g., "I would use a decimal for recording the length or mass of an object, and a fraction for part of an hour.");	Units 4, 8
represent perfect squares and square roots, using a variety of tools (e.g., geoboards, connecting cubes, grid paper);	1.3
explain the relationship between exponential notation and the measurement of area and volume;	1.4

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
Operational Sense divide whole numbers by simple fractions and by decimal numbers to hundredths, using concrete materials (e.g., divide 3 by $\frac{1}{2}$ using fraction strips; divide 4 by 0.8 using base ten materials and estimation);	4.7A (TG lesson)
use a variety of mental strategies to solve problems involving the addition and subtraction of fractions and decimals (e.g., use the commutative property: $3 \times \frac{2}{5} \times \frac{1}{3} = 3 \times \frac{1}{3} \times \frac{2}{5}$, which gives $1 \times \frac{2}{5} = \frac{2}{5}$; use the distributive property: 16.8 ÷ 0.2 can be though of as (16 + 0.8) ÷ 0.2 = 16 ÷ 2 + 0.8 ÷ 0.2, which gives 80 ÷ 4 = 84);	4.1, 4.2, 4.3, 4.4, 4.5 4.7, 4.8, 4.9 with supporting TG notes
solve problems involving the multiplication and division of decimal numbers to thousandths by one-digit whole numbers, using a variety of tools (e.g., concrete materials, drawings, calculators) and strategies (e.g., estimation, algorithms);	4.7 with supporting BLM
solve multi-step problems arising from real-life contexts and involving whole numbers and decimals, using a variety of tools (e.g., concrete materials, drawings, calculators) and strategies (e.g., estimation, algorithms);	1.1, 4.7, 4.8
use estimation when solving problems involving operations with whole numbers, decimals, and percents, to help judge the reasonableness of a solution;	1.1, 4.7, 4.8, 8.2
evaluate expressions that involve whole numbers and decimals, including expressions that contain brackets, using order of operations;	4.9, Skills You'll Need Unit 10
add and subtract fractions with simple like and unlike denominators, using a variety of tools (e.g., fraction circles, Cuisenaire rods, drawings, calculators) and algorithms;	4.2, 4.3, 4.4, 4.5
demonstrate, using concrete materials, the relationship between the repeated addition of fractions and the multiplication of that fraction by a whole number (e.g., $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} = 3 \times \frac{1}{2}$);	4.6

Specific Expectations	*Addison Wesley Mathematics Makes Sense Grade 7*, lessons:
add and subtract integers, using a variety of tools (e.g., two-colour counters, virtual manipulatives, number lines);	9.4, 9.5, 9.6, 9.7
Proportional Relationships determine, through investigation, the relationships among fractions, decimals, percents, and ratios;	8.1
solve problems that involve determining whole number percents, using a variety of tools (e.g., base ten materials, paper and pencil, calculators);	8.1, 8.2, 8.3, 8.5
demonstrate an understanding of rate as a comparison, or ratio, of two measurements with different units (e.g., speed is a rate that compares distance to time and that can be expressed as kilometres per hour);	2.5
solve problems involving the calculation of unit rates;	2.3, 2.4

Measurement

Overall Expectations

By the end of Grade 7, students will:

- report on research into real-life applications of area measurements;
- determine the relationships among units and measurable attributes, including the area of a trapezoid and volume of a right prism.

Students will:

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
Attributes, Units, and Measurement Sense research and report on real-life applications of area measurements (e.g., building a skateboard; painting a room);	Unit 6 Problem
Measurement Relationships sketch different polygonal prisms that share the same volume;	3.6, 6.4A (TG lesson)
solve problems that require conversion between metric units of measure (e.g., millimetres and centimetres, grams and kilograms, millilitres and litres);	Unit 2 Skills You'll Need, 2.4
solve problems that require conversion between metric units of area (i.e., square centimetres, square metres);	6.4B (TG lesson)
determine, through investigation using a variety of tools (e.g., concrete materials, dynamic geometry software) and strategies, the relationship for calculating the area of a trapezoid, and generalize to develop the formula [i.e., *Area* = (*sum of lengths of parallel sides* × *height)* ÷2];	6.3 with supporting TG note
solve problems involving the estimation and calculation of the area of a trapezoid;	6.3
estimate and calculate the area of composite two-dimensional shapes by decomposing into shapes with known area relationships (e.g., rectangle, parallelogram, triangle);	6.1, 6.4

Specific Expectations	*Addison Wesley Mathematics Makes Sense Grade 7*, lessons:
determine, through investigation using a variety of tools and strategies (e.g., decomposing right prisms; stacking congruent layers of concrete materials to form a right prism), the relationship between the height, the area of the base, and the volume of right prisms with simple polygonal bases (e.g., parallelograms, trapezoids), and generalize to develop the formula (i.e., Volume = area of base x height);	6.4A (TG lesson)
determine, through investigation using a variety of tools (e.g., nets, concrete materials, dynamic geometry software, Polydrons), the surface area of right prisms;	6.4B (TG lesson)
solve problems that involve the surface area and volume of right prisms and that require conversion between metric measures of capacity and volume (i.e., millilitres and cubic centimetres).	3.5, 3.6, 6.4A (TG lesson), 6.4B (TG lesson)

Geometry and Spatial Sense

Overall Expectations

By the end of Grade 7, students will:

- construct related lines, and classify triangles, quadrilaterals and prisms;
- develop an understanding of similarity, and distinguish similarity and congruence;
- describe location in the four quadrants of a coordinate system, dilatate two-dimensional shapes, and apply transformations to create and analyse designs.

Students will:

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, pages:**
Geometric Properties construct related lines (i.e., parallel; perpendicular; intersecting at 30º, 45º, and 60º), using angle properties and a variety of tools (e.g., compass and straight edge, protractor, dynamic geometry software) and strategies (e.g., paper folding);	7.1A (TG Technology feature)
sort and classify triangles and quadrilaterals by geometric properties related to symmetry , angles, and sides, through investigation using a variety of tools (e.g., geoboard, dynamic geometry software) and strategies (e.g., using charts, using Venn diagrams),	Unit 3 Skills You'll Need, 7.1, 7.5A (TG lesson)
construct angle bisectors and perpendicular bisectors, using a variety of tools (e.g., Mira, dynamic geometry software, compass) and strategies (e.g., paper folding), and represent equal angles and equal lengths using mathematical notation;	7.1B (TG Technology feature)
investigate, using concrete materials, the angles between the faces of a prism, and identify right prisms;	3.5 with supporting TG note, 6.4A (TG lesson)
Geometric Relationships identify, through investigation, the minimum side and angle information (i.e., side-side-side; side-angle-side; angle-side-angle) needed to describe a unique triangle (e.g., "I can draw many triangles if I'm only told the length of one side, but there's only one triangle I can draw if you tell me the lengths of all three sides.");	7.2

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
determine, through investigation using a variety of tools (e.g., dynamic geometry software, concrete materials, geoboard), relationships among area, perimeter, corresponding side lengths, and corresponding angles of congruent shapes;	7.2 with supporting TG note
demonstrate an understanding that enlarging or reducing two-dimensional shapes creates similar shapes;	Cross Strand Investigation, page 112, 7.2A (TG lesson)
distinguish between and compare similar shapes and congruent shapes, using a variety of tools (e.g., pattern blocks, grid paper, dynamic geometry software) and strategies (e.g., by showing that dilatations create similar shapes and that translations, rotations, and reflections generate congruent shapes;	7.2, 7.2A (TG lesson)
Location and Movement plot points using all four quadrants of the Cartesian coordinate plane;	9.7A (TG lesson)
identify, perform, and describe dilatations (i.e., enlargements and reductions), through investigation using a variety of tools, (i.e., dynamic geometry software, geoboard, pattern blocks, grid paper);	7.2B (TG Technology feature)
create and analyse designs involving translations, reflections, dilatations, and/or simple rotations of two-dimensional shapes, using a variety of tools (e.g., concrete materials, Mira, drawings, dynamic geometry software) and strategies (e.g., paper folding);	Unit 7 Problem, 7.3, 7.4, 7.5, Technology feature, page 274
determine, through investigation using a variety of tools (e.g., pattern blocks, Polydrons, grid paper, tiling software, dynamic geometry software, concrete materials), polygons or combinations of polygons that tile a plane, and describe the transformation(s) involved;	7.4

Patterning and Algebra

Overall Expectations

By the end of Grade 7, students will:

- represent linear growing patterns (where the terms are whole numbers) using concrete materials, graphs, and algebraic expressions;
- model real-life linear relationships graphically and algebraically, and solve simple algebraic equations using a variety of strategies, including inspection and guess and check.

Students will:

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
Patterns and Relationships represent linear growing patterns, using a variety of tools (e.g., concrete materials, paper and pencil, calculators, spreadsheets) and strategies (e.g., make a table of values using the term number and the term; plot the coordinates on a graph; write a pattern rule using words);	1.5, Unit 1 Problem, 10.1, 10.2
make predictions about linear growing patterns, through investigation with concrete material;	1.5, 10.1, 10.2
develop and represent the general term of a linear growing pattern, using algebraic expressions involving one operation (e.g., the general term for the sequence 4, 5, 6, 7, … can be written algebraically as $n + 3$, where n represents the term number; the general term for the sequence 5, 10, 15, 20, … can be written algebraically as $5n$, where n represents the term number);	10.1 with supporting TG note
compare pattern rules that generate a pattern by adding or subtracting a constant, or multiplying or dividing by a constant, to get the next term (e.g., for 1, 3, 5, 7, 9, …, the pattern rule is "start at 1 and add 2 to each term to get the next term") with pattern rules that use the term number to describe the general term (e.g., for 1, 3, 5, 7, 9, …, the pattern rule is "double the term number and subtract 1", which can be written algebraically as $2 \times n - 1$);	10.1
Variables, Expressions, and Equations model real-life relationships involving constant rates where the initial condition starts at 0 (e.g., speed, heart rate, billing rate), through investigation using tables of values and graphs);	2.5, 10.2

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
model real-life relationships involving constant rates (e.g., speed, heart rate, billing rate), using algebraic equations with variables to represent the changing quantities in the relationship (e.g., the equation $p = 4t$ represents the relationship between the total number of people that can be seated (p) and the number of tables (t), given that each table can seat 4 people [4 people per table is the constant rate]);	10.3
translate phrases describing simple mathematical relationships into algebraic expressions (e.g., one more than three times a number can be written algebraically as $1 + 3x$ or $3x + 1$), using concrete materials (e.g., algebra tiles, pattern blocks, counters);	10.3
evaluate algebraic expressions by substituting natural numbers for the variables;	10.4
make connections between evaluating algebraic expressions and determining the term in a pattern using the general term (e.g., for 3, 5, 7, 9, …, the general term is the algebraic expression $2n + 1$; evaluating this expression when $n = 12$ tells you that the 12^{th} term is $2(12) + 1$, which equals 25);	10.3, 10.4 with supporting TG notes
solve linear equations of the form $ax = c$ or $c = ax$ and $ax + b = c$ or variations such as $b + ax = c$ and $c = bx + a$ (where a, b, and c are natural numbers) by modelling with concrete materials, by inspection, or by guess and check, with and without the aid of a calculator (e.g., "I solved $x + 7 = 15$ by using guess and check. First I tried 6 for x. Since I knew that 6 plus 7 equals 13 and 13, is less than 15, then I knew that x must be greater than 6.").	10.5, 10.6

Data Management and Probability

Overall Expectations

By the end of Grade 7, students will:

- collect and organize categorical, discrete, or continuous primary data and secondary data and display the data using charts and graphs, including relative frequency tables and circle graphs ;
- make and evaluate convincing arguments, based on the analysis of data;
- compare experimental probabilities with the theoretical probability of an outcome involving two independent events.

Students will:

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
Collection and Organization of Data collect data by conducting a survey or an experiment to do with themselves, their environment, issues in their school or community, or content from another subject and record observations or measurements;	5.1, 5.2, 5.3, Cross Strand Investigations, pages 286 and 432
collect and organize categorical, discrete, or continuous primary data and secondary data (e.g., electronic data from websites such as E-Star or Census At Schools) and display the data in charts, tables, and graphs (including relative frequency tables and circle graphs), that have appropriate titles, labels (e.g., appropriate units marked on the axes), and scales (e.g., with appropriate increments) that suit the range and distribution of the data, using a variety of tools (e.g., graph paper, spreadsheets, dynamic statistical software);	5.1, 5.2, 5.3, Technology features in Unit 5, Cross Strand Investigations, pages 286 and 432, 8.4
select an appropriate type of graph to represent a set of data, graph the data using technology, and justify the choice of graph (i.e., from types of graphs already studied);	Unit 5 Technology Feature, page 193
distinguish between a census and a sample from a population;	5.1 with supporting TG note
identify bias in a data collection methods;	5.1

Specific Expectations	***Addison Wesley Mathematics Makes Sense Grade 7*, lessons:**
Data Relationships read, interpret, and draw conclusions from primary data (e.g., survey results, measurements, observations) and from secondary data (e.g., temperature data or community data in the newspaper, data from the Internet about populations) presented in charts, tables, and graphs (including relative frequency tables and circle graphs);	5.1, 5.2, 5.3, 5.5, Unit 5 Technology Features, pages 172, 185, and 193, Cross Strand Investigations, pages 286 and 432, 8.4
identify, through investigation, graphs that present data in misleading ways (e.g., line graphs that exaggerate change by starting the vertical axis at a point greater than zero);	5.6
determine, through investigation, the effect on a measure of central tendency (i.e., mean, median, and mode) of adding or removing a value or values (e.g., changing the value of an outlier may have a significant effect on the mean but no effect on the median)	5.5 with supporting BLM
identify and describe trends, based on the distribution of the data presented in tables and graphs, using informal language;	5.4
make inferences and convincing arguments that are based on the analysis of charts, tables, and graphs;	5.2, 5.3, Unit 5 Technology Feature, page 185, 5.4
Probability research and report real-world applications of probabilities expressed in fraction, decimal, and percent form (e.g., lotteries, batting averages, weather forecasts, elections);	11.2, 11.3, 11.4
make predictions about a population when given a probability;	11.4 with supporting TG note
represent in a variety of ways (e.g., tree diagrams, tables, models, systematic lists) all the possible outcomes of a probability experiment involving two independent events (i.e., one event does not affect the other event), and determine the theoretical probability of a specific outcome involving two independent events);	11.1
perform a simple probability experiment involving two independent events, and compare the experimental probability with the theoretical probability of a specific outcome.	11.3, 11.4 with supporting TG note

Addison Wesley
Mathematics
Makes Sense

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